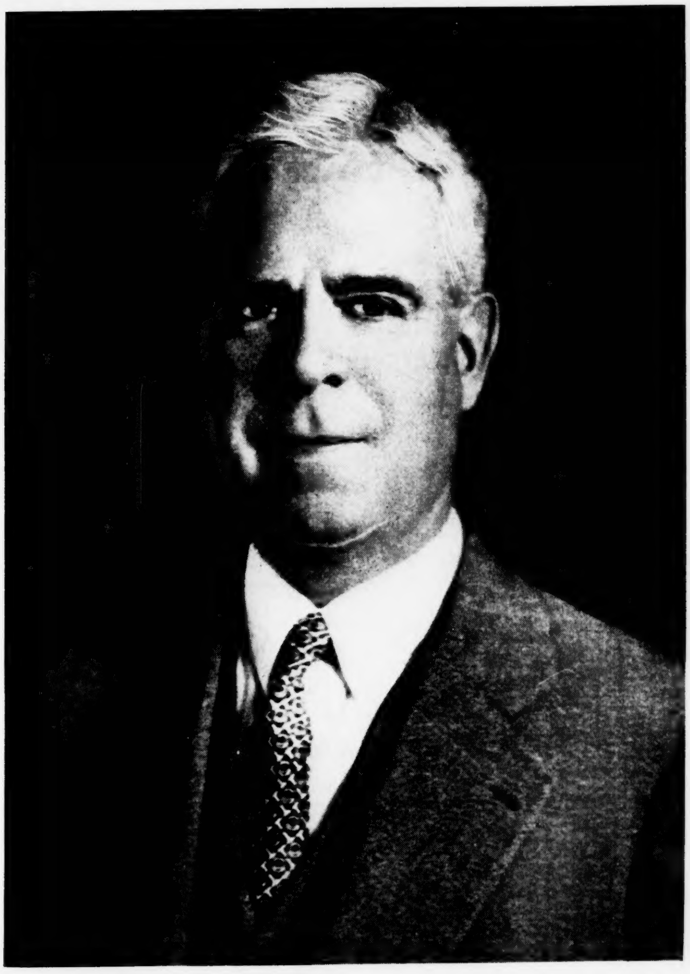
Metals Review

February 1957



Albert E. White
Founder Member, First President
(See Article, Page 5)

Metals Review

The News Digest Magazine

February 1957

Volume XXX, No. 2

Important Lectures

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ASM Review of Metal Literature

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Published monthly by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio: D. S. Clark, President; G. M. Young, Vice-President; C. H. Lorig, Treasurer; W. H. Eisenman, Secretary; G. E. Shubrooks, H. A. Wilhelm, G. A. Fisher and Carl E. Swartz, Trustees; A. O. Schaefer, Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930 at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879.

Claims for missing numbers will not be allowed if received more than 60 days from date of issue.. No claims allowed from subscribers from overseas, or because of failure to notify the circulation department of a change of address or because copy is "missing from files".

Albert E. White, Founder Member, First President A.S.M., Dies

Albert E. White, professor emeritus of metallurgical engineering at the University of Michigan and director emeritus of the University's Engineering Research Institute, died in Ann Arbor on Dec. 18 at the age of 72. Prof. White suffered from a cerebral hemorrhage in July and had been hospitalized since that time.

Recognized as one of the University's outstanding teachers, administrators and research scientists, he had been in retirement since June 1954.

Prof. White was born in Plainville, Mass., and attended Brown University, where he received an A.B. degree in 1907. After a year of graduate engineering studies at Harvard University under Albert Sauveur, he became a research engineer for the Jones and Laughlin Steel Co. In 1911 he came to the University of Michigan as an instructor in the department of chemical and metallurgical engineering.

During World War I, Prof. White served as head of the inspection division of the Army Ordnance Department. He attained the rank of major while on active duty, and was promoted to lieutenant colonel in the Army Ordnance Reserve Corps when he returned to civilian life.

After the War, Prof. White returned to the University as a full professor. The following year saw the establishment of the University's department of engineering research, created to carry on sponsored research in engineering and the physical sciences for industrial and government organizations. Prof. White was appointed director of the new department, a position he held for 33 years.

Under his guidance, the Engineering Research Institute grew from a small organization involving a handful of research projects to an institution which, in the final year of his administration, carried on over eight million dollars worth of research.

During the Second World War, Prof. White again served his country as a specialist in metallurgy. He was chairman of the Metallurgical Research Committee of the National Defense Research Council and a member of the Metallurgical Committee of the Office of Scientific Research and Development.

After World War I, Prof. White was instrumental in founding the American Society of Metals and served as the society's first president. He also was president of the American Society for Testing Materials, and this spring was named an honorary member of that Society.

Prof. White's main interest lay in the field of high-temperature metallurgy, and his contributions to that field have played an important role in the development of materials for such high-temperature applications as gas-turbine engines and jet-aircraft power plants.

Prof. White's 40 years of teaching and research made his influence widely felt, not only by virtue of his contributions to metallurgical engineering, but also through those of his students and coworkers. Among these are such men as A. H. d'Arcambal, president and general manager of Pratt and Whitney; Walter Jominy, chief research metallurgist, Chrysler Corp., John Chipman, chairman of the department of metallurgy, Massachusetts Institute of Technology, and J. W. Freeman, professor of metallurgical engineering, University of Michigan.

In recognition of his outstanding service in the field of metallurgical engineering, Prof. White was awarded an honorary Doctor of Science degree by his alma mater, Brown University, in 1925.

Louisville Schedules Corrosion Symposium

The **Louisville Chapter**, in cooperation with the Ohio Valley Section of the National Association of Corrosion Engineers, is presenting a Corrosion Symposium on Mar. 1, 1957. The meeting will be held at General Electric Co.'s Appliance Park, in Louisville, and will be a full-day meeting. The program is as follows:

Morning

Fundamentals of Corrosion, by Norman Hackerman, University of Texas.

Corrosion of Stainless Steel, by G. Paul, International Nickel Co.

Lunch
12:30 p.m.

Afternoon

Corrosion of Copper and Copper-Base Materials, by A. W. Tracy, American Brass Co.

Corrosion of Aluminum, by M. J. Pryor, Kaiser Aluminum & Chemical Corp.

Recess for Dinner

Evening

Protective Measures, by W. W. Bradley, Bell Telephone Laboratories.

The program is one which should be of interest to engineering people, laboratory people and supervisors of maintenance and industrial operations.

For registration or information, contact: D. C. Brown, Tube Turns, Inc., 2820 West Broadway, Louisville, Ky.

New Films

Aluminum in Modern Architecture

A documentary motion picture on the "world-of-tomorrow" uses of aluminum in construction and design is available to interested groups through Association Films, 347 Madison Ave., New York 17. The 13½-min. film was produced by the Reynolds Metals Co. It shows how aluminum has revolutionized many concepts of design and beauty in the construction of churches, schools, offices, public buildings and homes.

How to Make a Motor Go
How to Take Step Seven

Two 20-min., 35-mm. colored sound slide films which show maintenance people how to install and properly maintain electric motors are available from Allis-Chalmers. The films, covering maintenance and installation, depict by means of cartoon characters and illustrations how motors can be kept in good operating condition. Loan of the films can be arranged by contacting Allis-Chalmers Manufacturing Co., Industries Group, Milwaukee 1, Wis.

San Fernando Hears Talk on High-Temperature Materials

Speaker: W. R. Kegerise
Carpenter Steel Co.

At a meeting of the recently organized **San Fernando Valley Chapter**, 51 members and guests heard W. R. Kegerise, development metallurgist, Carpenter Steel Co., discuss "High-Temperature Materials".

He first pointed out some recent developments in chromium ferritic steels. An alloy which nominally contains 12% chromium and 10% molbdenum was described in detail.

A number of mechanical properties were presented, together with a description of the aging characteristics. This material was a recent development of Carpenter Steel laboratories and is still considered to be in the experimental stages. The discussion continued into the field of austenitic stainless steels and included such materials as 16-25-6, A-286, and others.

As increasingly greater temperatures were considered, the discussion proceeded to nickel and cobalt-base superalloys.

Mr. Kegerise summarized his talk and included some discussion on alloys and potential developments for the future.—**Reported by R. P. Frohmberg for San Fernando Valley.**

ASM-SLA LITERATURE CLASSIFICATION REVISED

A revision and expansion of the ASM-SLA Classification of Metallurgical Literature is now being completed by the A.S.M. Committee on Literature Classification. The main headings, with principal changes and additions, indicated by italics, are shown in the following pages for the convenience of those who follow the coding in *Metals Review* annotations. The complete classification, together with text and alphabetical index, will be published in late spring.

The revised classification follows the same outline and principles as the first edition published in 1950. New headings and subdivisions have been added to facilitate indexing in fields of knowledge which have developed substantially since 1950. (The metallurgy of atomic energy is an important example.) Expansions have also been made to provide greater depth of indexing in fields where experience has shown this to be desirable. Where corrections were obviously necessary in the original outline they have been made without assigning new meanings to existing coding combinations, so that files which have been built up according to the original outline can be maintained and readily converted to the revised system.

Coding in Metals Review

Henceforth annotations published in the A.S.M. Review of Metal Literature and in other A.S.M. publications will be coded in greater detail than has been the practice in the past. Previous practice has been to code only as far as second orders in the Processes and Properties and Materials Indexes and to omit coding entirely in the Common Variables Index. It is felt that a more accurate and complete indication of subject content will be provided by coding into third orders where appropriate and by including desirable coding in the Common Variables Index, and this practice was followed starting with the January 1957 issue of *Metals Review*. Coding is now based on the revised edition of the classification.

Several expedients are being adopted to clarify coding sequence. All Processes and Properties Index codings are shown first, separated by commas, and accompanied by appropriate Common Variables Index coding. Materials Index codings follow, separated from the Processes and Properties coding by a semicolon, and also accompanied by Common Variables codings that refer to aspects of the material. Base metals are shown in roman type, and alloying elements, addition materials, coating materials, etc. are shown in italic.

The following condensed outline shows only the second order subdivisions and does not reflect the large amount of additional material which has been incorporated at the third order level. For example, in Section A—General Metallurgy, third order headings have been added generously to help in organizing the business literature that is such an important adjunct to many technical files.

Processes and Properties Index

Another important addition in the Processes and Properties Index consists of two entirely new sections to accommodate literature which deals with metallurgical equipment. New Section W is designed to classify plant or processing equipment, and Section X laboratory and testing equipment. Coding in these sections will be used to indicate the design, construction and function of equipment as distinct from the operation of a process. The use of metals in the equipment will be indicated by an appropriate code in the Common Variables Index.

Another important change in the Processes and Properties Index is the elimination of Section V—Materials, which appeared to be an unnecessary complication in the original outline. Henceforth articles dealing with materials in a broad and general way will be classified in Section A—General Metallurgy, together with the appropriate materials codes.

Materials Index

The Materials Index has been simplified and condensed in some places and expanded in others. Eight elements have been added to the "Common Elements", which will simplify punched card coding for some of the metals now coming into wider use.

The condensations have been made in the subdivisions of the "Common Elements and Their Alloys" and the subdivisions of the ferrous groups, which contained a number of inconsistencies in the original version. These subdivisions also were based almost entirely on American practice and therefore were not adaptable to use in other countries. It is hoped that eventually a classification of alloys can be devised based entirely on composition, but this will require further cooperation with groups in other countries working on metallurgical classification.

The new sections include one on Nonmetallic Materials, one on Industrial Raw Materials, and one on Addition Agents. These sections will be particularly useful in referring to articles on the use of refractories, lubricants, chemicals and similar materials in metallurgical processing.

Another new section has been opened to provide for expansion of the original SG group, "Materials Classified by Properties and Applications". The original group is now coded SGA and the new addition SGB.

In the Common Variables Index, five new sections have been added as shown on the following outline, wherein that section is printed in full.

For those who maintain an ASM-SLA punched card literature file, little difficulty will be encountered in changing from the original to the revised outline. The changes in the card itself will be very minor, and the new cards will be printed in a different color ink so they can readily be distinguished in the file. More than a million ASM-SLA punched cards have been sold since the system was introduced in 1950.

Cooperating Bodies

Four of the members of the A.S.M. Committee on Literature Classification are also members of the Special Libraries Association, so that the revision, like the original classification, can be considered to be a joint project of the two societies.

The committee has also worked very closely with the Documentation Committee of the Italian Association of Metallurgy, and many of the changes and expansions are the result of suggestions made by the Italians. Assistance has also been given by the Verein Deutscher Eisenhuttenleute and by the Subcommittee on Technical Research of the European Coal and Steel Community (CECA), and efforts to establish the ASM-SLA Classification as an international standard for organization of metallurgical literature are continuing. The membership of the A.S.M. Committee is as follows:

Frank T. Sisco, Director, Engineering Foundation—Chairman

E. A. Clapp, Research Engineer, Metals Research Laboratories, Electro Metallurgical Co.

F. Forscher, Supervisor, Mechanical Metallurgy, Westinghouse Atomic Power Div.

L. S. Foster, Chief, Atomic Energy Division, Ordnance Materials Research Office, Watertown Arsenal

C. D. Gull, Administrative Officer, Division of Engineering and Industrial Research, National Academy of Sciences—National Research Council

W. W. Howell, Assistant Editor, *Chemical Abstracts*

I. H. Jenks, Head, Publications Division, Aluminium Laboratories Ltd.

Allen Kent, Associate Director, Center for Documentation and Communication Research, Western Reserve University

D. J. Maykuth, Associate Consultant in Metallurgy, Battelle Memorial Institute

E. C. Wallace, Chief Metallurgist, New York Air Brake Co.

Frederica M. Weitlauf, Librarian, Research and Development Dept., Inland Steel Co.

Marjorie R. Hyslop, Editor, A.S.M. Review of Metal Literature, American Society for Metals—Secretary.

ASM-SLA Classification, Revised Edition, 1957

Condensed Outline of Principal and New Subdivisions

Processes and Properties Index

A—General Metallurgical

2. History
3. Education
4. Statistics and economics
5. Plant *management*
6. Industrial relations
7. Health and safety
8. *Industrial pollution and waste disposal*
9. Research *and development*
11. *Conservation of resources*
12. *Professional activities*
13. *Laws and legal actions*
14. *Literature techniques*
15. *Audio-visual techniques*

B—Ore and Raw Material Preparation

12. Mining methods
13. Crushing, grinding and sizing
14. Concentration (beneficiation)
15. Roasting and calcining
16. *Sintering processes*
17. *Fuel distillation and gasification*
18. *Processing of* fuels
19. *Processing of* refractories
23. *Processing of scrap*
24. *Water treatment*
25. *Production of industrial gases*

C—*Extraction and Refining*

19. *Chemical extraction*
21. *Nonferrous* smelting
22. Distillation
23. Electrolytic processes
25. *Nonferrous* vacuum methods
26. Reduction by metals *and gases*
27. *Precipitation* (*replacement*)
28. Separation of metals
29. Amalgamation
1. *Decomposition*
5. *Nonferrous melting and* casting
6. *Isotope separation*

D—*Iron and* Steelmaking

1. Blast furnace *practice*
2. Openhearth *practice*
3. Bessemer process
5. Electric arc processes
6. Electric induction *practice*
7. *Multistage processes*
8. *Special processes*
9. Ingot casting
10. *Oxygen furnace processes*
11. *Physical chemistry of iron and steelmaking*

E—Foundry

10. Melting techniques
11. Sand casting
12. Permanent mold casting
13. Die casting
14. Centrifugal casting
15. Precision investment casting
16. Other methods
17. Pattern *making*
18. Sand technology
19. Molding
21. Coremaking
22. Rigging
23. Pouring
24. *Casting cleaning*
25. Metallurgical control
26. *Casting reclamation*

F—Primary Mechanical Working

21. Preparation for working
22. Forging (hammer and press)
23. Rolling
24. Extrusion of *rod, shapes and tube*
25. Swaging
26. Tubemaking (*except extrusion*)
27. Drawing of rod *and shapes*
28. Wire drawing
29. Finishing operations

G—Secondary Mechanical Working

1. Presswork in general
2. *Shearing*
3. Stamping
4. Drawing
5. Impact *and cold* extrusion
6. Bending
9. Stretch forming
10. Heading
11. Roll forming
12. Thread rolling
13. Spinning
14. Bulging
16. Die sinking
17. Machining, *mechanical*
18. Grinding
19. *Finish machining*
22. Flame and arc cutting
23. *Finish forming*
24. *Special machining methods*

H—Powder Metallurgy

10. Powder production
11. Powder properties
12. Mixing *and* blending
14. Molding *and* compacting
15. Sintering
16. Post-sintering operations
17. *Fiber metallurgy*

J—Heat Treatment

21. Homogenization
22. Austenitizing
23. Annealing
24. Normalizing
25. Patenting
26. *Quenching*
27. Precipitation hardening
28. Case hardening
29. Tempering
1. *Residual stress control*
2. Heating and cooling *methods*
3. *Other carbon diffusion processes*
4. *Surface alterations*
5. *Hardenability*

K—*Assembling and* Joining

1. Arc welding
2. Gas welding
3. Resistance welding
4. Thermit welding
5. Forge welding
6. Other welding processes
7. Soldering
8. Brazing
9. *Process control*
11. Bonding metals to nonmetals
12. Adhesive joining
13. Mechanical *assembling*

L—Cleaning, Coating and Finishing

10. Mechanical cleaning and polishing
12. Chemical cleaning and polishing
13. Electrochemical cleaning and polishing
14. Chemical *conversion* coating
15. Diffusion coating
16. Dip coating
17. Electroplating
18. Electroforming
19. *Anodic coating*
21. Cathodic oxide coating
22. Cladding *or bonding*
23. Metal spraying
24. *Coating by weld-deposition*
25. *Coating by vapor-deposition*
26. Painting and organic coating
27. Ceramic coating (vitreous enameling)
28. *Coating by chemical reduction*
29. *Other methods*

M—Metallography, Constitution and Primary Structure

20. *Specimen preparation*
21. Microscopy
22. Diffraction methods
23. Other techniques
24. Phase diagrams
25. *Atomic and molecular* structures
26. Crystal structures
27. *Primary* microstructures
28. Macrostructure

N—Transformations and Resulting Structures

1. Diffusion
2. Nucleation
3. Grain growth
4. Recovery
5. Recrystallization
6. *Diffusionless transformations*
7. Precipitation
8. Austenite formation *and decomposition* (Fe-C system)
9. Other eutectoid reactions
10. Superlattice formation
11. Other solid-state reactions
12. Liquid-solid reactions
14. Liquid-*liquid* reactions
15. *Gas*-solid reactions
16. *Gas*-liquid reactions

P—Physical Properties

10. Mass *and volume*
11. Thermal
12. Thermodynamics *and kinetics*
13. *Surface properties*
15. Electrical *and electrochemical*
16. Magnetic
17. *Radiation properties* (*electromagnetic*)
18. *Nuclear*

Q—Mechanical Properties and Tests

21. Elastic properties
22. Anelastic properties
23. Plastic properties
24. Plastic deformation *mechanism*
25. Stresses
26. Fracture *mechanism*
27. Tension *test*
28. Compression *test*
29. Hardness *test*
1. Torsion *test*
2. Shear *test*
3. Creep *test*
5. Bend *test*
6. Impact *test*
7. Fatigue *test*
8. Damping *test*
9. Wear *tests*
10. *Other tests*

R—Corrosion

1. Mechanism of corrosion
2. Corrosive effects
3. Atmospheric corrosion
4. Waters

(*Continued on p. 8*)

6. *Chemicals, inorganic*
7. Chemicals, organic
8. Soils
10. Preventive measures
11. Tests

S—Inspection and Control

10. Sorting and identification
11. Composition analysis
12. Statistical *analysis and* control
13. Flaw detection
14. Size, *thickness and mass* measurement
15. Surface roughness
16. Temperature measurement and control
18. Process control *and measurement*
19. Radiation detection and *measurement*
21. Miscellaneous service *testing* (life testing)
22. Standard *practice* and specifications
23. *Calibration*

T—Metal Products and Parts

21. Automotive
22. Marine
23. Railroad
24. Aircraft
26. Structures
29. Chemical *processing*
1. *Electrical and electronic components*
2. *Ordnance material*
3. Agriculture
4. Civil engineering
6. *Tools*
7. Machine parts
9. Arts *and crafts*
10. Consumer *goods*
11. *Nuclear reactor components*

U—Allied Fields

1. Physics
2. Chemistry
3. Ceramics
4. Mathematics (statistics and nomographs)
5. Geology
6. Mineralogy and petrography
7. Engineering
10. *Mechanics*
11. *Biology*

W—*Plant Equipment*

10. *Plant installations*
11. *Power generation and distribution*
12. *Materials handling and transportation*
13. *General service equipment*
14. *Mining and oil field*
15. *Coal and ore preparation*
16. *Fuel distillation and gasification*
17. *Furnaces and equipment for primary metallurgy*
18. *Melting and refining furnaces and equipment*
19. *Casting*
20. *Ingot and slab preparation*
22. *Forging*
23. *Rolling*
24. *Forming and shaping*
25. *Machine tools*
26. *Metal powder processing*
27. *Heat treating furnaces*
28. *Other heat treating equipment*
29. *Welding, brazing and soldering*
1. *Mechanical joining*
2. *Mechanical cleaning and finishing*
3. *Chemical and electrochemical cleaning and finishing*
4. *Other cleaning and finishing*

X—*Instrumentation—Laboratory and Control Equipment*

20. *Size, thickness and mass*
21. *Composition*
23. *Surface properties*
24. *Thermal properties*
25. *Electrical properties*
26. *Magnetic properties*
27. *Nuclear properties*
28. *Elastic and anelastic properties*
29. *Mechanical properties*
1. *Corrosion*
2. *Radiation detection*
3. *Micrography*
4. *Metallography*
5. *Photography and other visual aids*
6. *Sorting and identification*
7. *Atmosphere and humidity*
8. *Flaw detection*
9. *Temperature*
10. *Electrical energy*
11. *Magnetic fields*
12. *Pressure*
13. *Rate and time*
14. *Computers*
15. *Communication*

Materials Index

Common Elements and Their Alloys

Ag—Silver
Al—Aluminum
B—Boron
Be—Beryllium
C—Carbon
Cb—Columbium
Co—Cobalt
Cr—Chromium
Cu—Copper
Fe—Iron
Mg—Magnesium
Mn—Manganese
Mo—Molybdenum
Ni—Nickel
Pb—Lead
Si—Silicon
Sn—Tin
Ta—Tantalum
Ti—Titanium
U—Uranium
V—Vanadium
W—Tungsten
Zn—Zinc
Zr—Zirconium

Materials Groups

EG—Element Groups (individual elements coded by chemical symbol)
ST—Steel
CN—Carbon Steel
AY—*Low*-Alloy Steel (5% *Alloy Max.*)
SS—*High-Alloy Steel (Including* Stainless *and Heat Resisting)*
TS—Tool *and Die* Steel
CI—Cast Iron
SGA—Materials by Properties and Applications (*Group A*)
SGB—*Materials by Properties and Applications (Group B)*
NM—*Nonmetallic Materials*
RM—*Industrial Raw Materials*
AD—*Addition Agents*

SGB—*Materials by Properties and Applilations (Group B)*

n. *High nuclear cross-section*
p. *Low nuclear cross-section*
q. *Hard materials*
r. *Low-temperature*
s. *Structural*
a. *High-strength*

NM—*Nonmetallic Materials*

a. *Inorganic compounds*
b. *Organic compounds*
c. *Catalysts*
d. *Polymers*
e. *Minerals (nonmetallic)*
f. *Ceramic materials*
g. *Coatings (nonmetallic)*
h. *Lubricants and oils*
j. *Abrasives*
k. *Other*

RM—*Industrial Raw Materials*

g. *Industrial gases (non-elemental)*
h. *Refractories*
j. *Solid fuels*
k. *Liquid fuels*
m. *Gaseous fuels*
n. *Ores*
p. *Scrap*
q. *Fluxes and slags*

AD—*Addition Agents*

n. *Alloying agents*
p. *Structure-controlling agents*
q. *Agents imparting specific properties*
r. *Deoxidizers*
s. *Oxidizers*
a. *Desulphurizers*

Common Variables Index

1. *Manufacturing and Test Methods*
   2. *Use of* equipment
   4. Test methods
   5. *Use of* furnaces
   11. *Continuous*
   12. *Batch*
   13. *Cyclic*
   14. *Acid*
   15. *Basic*
   16. *Hot*
   17. *Cold*
   18. *Electrical*
   19. *Induction*
   20. *Use of gas*
   21. *Use of oil*
   22. *Use of air (compressed)*
   23. *Vacuum*
   24. *Ultrasonic*
2. Influencing factors
   9. Effect of grain size
   10. Effect of composition
   11. Effect of temperature
   12. High temperature
   13. Low temperature
   14. *Effect of heat treatment*
   15. *Effect of aging*
   16. *Effect of chemical environment*
   17. *Effect of irradiation*
3. Influencing factors
   16. *Effect of stress*
   17. Effect of time or rate
   18. Effect of deformation or strain
   19. Effect of impurities
   20. Effect of prior history
   21. Effect of prior structure
   22. Effect of orientation
   23. Size and shape effects
   24. Effect of pressure
4. Metal Forms, Wrought
   1. Forgings
   2. Blooms and billets
   3. Sheet, strip and plate
   5. Bars and rods
   6. Foil
   7. Shapes (I-beams, rails, etc.)
   8. Extrusions
   9. Stamping
   10. Tubing and pipe
   11. Wire
   12. *Wool*

5. Metal Forms, Cast
   9. Ingots
   10. Sand castings
   11. Die castings
   12. Investment castings
   13. Permanent mold castings
   14. Semi-permanent mold castings
   15. Centrifugal castings
   16. Chill castings

6. Metal Forms, Powder
   17. Pellets and shot
   18. Loose powders
   19. Cemented carbides
   20. Metal ceramics
   21. Porous metal *parts*
   22. Structural parts
   23. *Briquettes*

7. Metal Forms, Assembled
   1. Welded
   2. Brazed and soldered
   3. Riveted
   4. Bolted
   5. Screwed
   6. Pressed fits
   8. *Bonded*
   9. *Composite*

8. Metal Forms, Coated
   12. *Electroplated*
   15. Dip coated
   16. Clad or bonded (*metal to metal*)
   17. Sprayed
   18. Hard surfaced
   19. Chemically coated
   20. Painted
   21. Enameled
   22. Vapor coated

9. Defects
   17. Pipe
   18. Porosity or blowholes
   19. Segregation and inclusions
   20. Flakes
   21. Surface defects (seams, laps, etc.)
   22. Cracks (quenching, grinding, corrosion)
   23. Overheating
   24. Distortion
   1. Impurities
   2. *Scale*

10. Type of literature
   1. Theory
   2. Research
   3. Original techniques
   4. Review
   5. Plant description

11. Form of literature
   9. Patent
   10. Trade literature
   12. Specification
   13. Report
   14. Book
   15. Bibliography
   16. *Translation*
   17. *Glossaries, definitions, directories*
   18. *Data books and handbooks*
   19. *Trade names*
   20. *Microfilm and microcards*

12. Language
   17. French
   18. German
   19. Russian
   20. Italian
   21. Oriental
   22. Swedish
   23. Spanish
   24. *English*

13. Geography

14. *States of Metals*
   9. *Minerals*
   10. *Liquid metals*
   11. *Single crystals*
   12. *Thin films*
   13. *Isotopes*
   15. *Colloids*
   16. *Amorphous*
   17. *Solid solutions*
   18. *Compounds (oxides, hydrides, carbides, etc.)*
   19. *Heat treated*

15. *Material Designations (Specifications and Standards)*
   17. *A.S.A.*
   18. *A.S.T.M.*
   19. *S.A.E.*
   20. *A.I.S.I.*
   21. *A.P.I.*
   22. *A.M.S.*
   23. *A.S.M.E.*
   24. *Government*
   4. *I.S.O. (International Organization for Standardization)*
   5. *B.S. (British)*
   6. *D.I.N. (German)*
   7. *U.N.I. (Italian)*
   8. *C.S.A. (Canadian)*
   9. *N.F. (French)*
   10. *G.O.S.T. (Russian)*
   11. *Other*

16. *Energy sources*
   9. *Chemical*
   10. *Mechanical*
   11. *Electricity*
   12. *Atomic*
   13. *Solar*

17. *General Concepts*
   1. *Design*
   2. *Performance characteristics*
   3. *Cost*
   4. *Quality*
   5. *Tolerances*
   6. *Models*
   7. *Applications of materials*

18. *Plant Practice*
   17. *Layout*
   19. *Construction*
   20. *Erection and installation*
   21. *Maintenance*
   22. *Repair*
   23. *Lubrication*
   24. *Automation*

Corrections for January Coding

Coding of literature annotations in the January issue of Metals Review *based on the revised edition of the ASM-SLA Classification was started before some final decisions had been made by the Committee. Some of the coding symbols have since been changed and were printed incorrectly in the January issue. Corrected coding (with references identified by serial number) is shown below.*

Item No.	Corrected Coding
5-A	(A general; Ni)
9-A	(A general; SGA-n, SGA-h)
13-A	(A general; 14-13, 2-17)
17-A	(A general, R general; Mo, 17-7)
21-A	(A4q; ST, RM-p)
24-A	(A5, J23, 1-11; ST)
1-B	(B17g; RM-q)
6-B	(B17, D1; RM-j43)
7-B	(B19, D2; RM-h)
6-D	(D10; RM-h, ST)
11-D	(D8p; RM-q, Fe)
16-D	(D9; RM-q, ST)
21-D	(D11n; RM-q)
22-D	(D1; ST, RM-n)
28-D	(D1b, A7p; 17-1)
29-D	(D11j, Fe, 14-9)
31-D	(D11k, D1b; Fe, RM-j 38)
1-E	(E general, 17-1; Al)
5-E	(E18p, NM-f 45)
6-E	(E19c, NM-f 45)
7-E	(E19c, NM-f 45)
8-E	(E19c, RM-h 35)
11-E	(E general, SGA-h)
19-E	(E general, 18-17)
23-E	(E25n, Q general, Ni, SGA-h)
25-E	(E18n, NM-f 45)
8-F	(F28; NM-h, ST)
14-F	(F23, 17-1; Cu)
3-G	(G1, Q23q)
7-G	(G18, G19, G17, T-6; Cu, 17-7)
10-G	(G4, G17k; SGA-h)
7-J	(J4a, J5; ST)
18-J	(J general, Q23d; AY, SGA-h)
19-J	(J5, N8g; TS)
8-K	(K1; RM-q, SS)
12-K	(K9s, K1; Ti)
18-K	(K8; SGA-f, Ag)
20-K	(K8; Al, RM-q)
23-K	(K7, 17-1; Sn)
24-K	(K9s; AY)
8-L	(L24, Q9; SGA-m)
20-L	(L19, 1-12)
25-L	(L12, L13p; SGA-g, SS, Al)
27-M	(M24; Cr, Ti, Ta, W, 14-18)
34-M	(M21p, L10b; NM-k37)
19-N	(N7d, Q23a; Mo, V, Ti, 14-18)
34-N	(N11, P12r; SGA-n)
28-P	(P12b; NM-a 33, RM-q)
27-Q	(Q23, Q25k, K general, 17-1)
32-Q	(Q7; ST, SGA-b, 4-11)
33-Q	(Q23q, R2q; Cb)
37-Q	(Q24, N8j, M26c; SS, 4-11)
40-Q	(Q23g, Q25k, 17-1)
65-Q	(Q27a; Al, 5)
31-R	(R2q, 2-10; EG-d, SGB-q)
53-R	(R1d, 17-1; 7-1)
14-S	(S23; SGA-a, W, Mo)
24-S	(S11; RM-q, Fe, Cr, Mg, Mn)
12-T	(T24; SGA-h, SS)
13-T	(T24, T25; SS, SGA-h)
1-W	(W19, 17-1)
2-W	(W17; RM-h 39)
3-W	(W11, K general; AY, 17-7)
4-W	(W18; RM-h)
10-W	(W29; SS, 17-7)
11-W	(W17, 2-12; Ni, 17-7)
12-W	(W29; Fe, 17-7)
13-W	(W19; RM-h)
14-W	(W19, F23; SGA-h, RM-h)
15-W	(W19, E23; RM-h)
6-X	(X4; ST, NM-a 35, 9-19)

Rhode Islanders Tour Brown & Sharpe

At a Meeting of the Rhode Island Chapter, Members Toured the Brown and Sharpe Manufacturing Co. After visiting the various departments, including the precision center and the production line of screw machines, Henry D. Sharpe, Jr., president, gave a talk on "Metallurgical Developments" at his company. Shown are, from left: Sidney Siegel, Metals and Controls Corp.; and Mr. Sharpe. (Reported by Marshall C. Battey)

Delivers Talk in Denver on Trace Elements in Metals

Speaker: Jerome Strauss

Vanadium Corp. of America

Jerome Strauss, vice-president, Vanadium Corp. of America, spoke before members of the **Rocky Mountain Chapter** on **"Trace Elements in Metals, for Better or for Worse".**

Mr. Strauss' lecture included part of the subject matter of the Gillett Memorial Lecture delivered before A.S.T.M. in 1953, adding thereto a number of new developments and on this occasion, not only beneficial additions in amounts up to several hundredths per cent, but also many detrimental additions.

The coverage was extremely broad and it was therefore possible only to indicate the wide range and to mention specifically a certain number of instances within that range covering in detail a few of major current interest.

Mention was made of several instances in which small amounts of an element imparted desirable properties to a particular metal or alloy at one quantity level but changed at another quantity level to a serious detriment.

The interpretation of these effects is, of course, dependent upon the use, and what is detrimental for one use, is beneficial for another. Common examples are the desirability in steels of either low or high levels of sulphur and phosphorus; at both the low and high levels there are valuable applications but neither level will properly fit the use that requires the other.

Stress was laid upon the effect of purity of the basic metals upon the properties of alloys made from those metals. One such example was shown as the result of adding 0.005% nickel to lead rated 99.998+% pure and increasing tensile strength about 9% as compared to the same amount of the same element added to lead of 99.98+% purity and increasing the tensile strength by over 40%.

Various other examples were cited in both the nonferrous and ferrous fields where minute additions effect desirable changes in the characteristics of the metals. Among the additions mentioned were arsenic, bismuth, cadmium, tin, magnesium, phosphorus, sulphur, silicon, sodium, beryllium, boron and others. Among the properties affected are drossing and volatilization in the molten state, tensile strength at room and at elevated temperatures, magnetic permeability, grain control or refinement, corrosion resistance, hardness, with or without heat treatment, hardenability, machinability and others.

Mr. Strauss used slides of graphs and charts to illustrate his lecture.—**Reported by V. D. Heinze for Rocky Mountain Chapter.**

Work Hardening of Metals in Press Operations Is Subject

Speaker: W. S. Wagner

E. W. Bliss Co.

Members of the **Carolinas Chapter** heard W. S. Wagner, development engineer, E. W. Bliss Co., speak on "Work Hardening of Metals in Press Operations" at a recent meeting.

Detailed discussion was presented on deformation nomographs of various metals in the start and follow-through of metal forming. It was interesting to note that "Tobin Bronze" was almost as high in its work hardening characteristics as stainless steels. Other subjects discussed were die design, reverse draws, coining, deep drawing and stamping.

A color motion picture was shown which illustrated the extent to which automation has been developed on presswork and on press combinations.—**Reported by A. F. Engelberg for Carolinas.**

Clark Speaks at Ontario Meeting

Donald S. Clark, National President A.S.M., Was the Guest Speaker at a Meeting Held by the Ontario Chapter. Shown at the speaker's table are, from left: Dr. Clark; T. G. Bradbury, Steel Co. of Canada Ltd., chairman; and Harold Chambers, Atlas Steel Co., a past chairman of the chapter

Presents Description Of Modern Extrusion Processes at Baltimore

Speaker: Earl Beatty
Kaiser Aluminum & Chemical Corp.

Earl Beatty, chief metallurgist for the Kaiser Aluminum & Chemical Corp.'s Halethorpe (Md.) extrusion works, presented an illustrated lecture on "Modern Extrusion Processes" at a meeting in **Baltimore.**

The production and consumption of wrought aluminum products has shown a marked increase since World War II while the production of extruded shapes has more than doubled in the last decade. The development of high-strength aluminum alloys has resulted in extreme versatility for the metal and modern extrusion techniques present an almost unlimited future in the industry.

At Halethorpe, Kaiser Aluminum operates two separate plants. One is a U.S. Air Force heavy press plant containing two 8000-ton presses and supporting auxiliary equipment. The other is the corporation's own facility where they are now completing a multimillion dollar expansion which will result in an eight-press plant with presses ranging from 1600 through 2500 tons, 2750 tons, 3500 and 4400 tons, plus a 500-ton press for research and development.

The 8000-ton presses are currently used primarily for aircraft extrusions, some weighing upwards of 50 lb. per ft. and exceeding 2 ft. in width. The smaller presses concentrate on commercial applications for the transportation, architectural and furniture industries.

Extrusion ingots are cast at Halethorpe by the direct chill method, following melting in a series of four gas-fired, reverberatory - type furnaces, each with a total capacity of 86,500 pounds. Ingots as large as 20 in. in diameter, 25 ft. in length and weighing more than 8000 lb. are cast on a regular production basis.

All ingots are ultrasonically tested at the casting stations prior to insertion in the homogenizing furnaces. The production of high sonic quality aluminum ingot is the constant aim and the results have been consistently remarkable.

Before extruding the various complex shapes the ingots are sawed into billet length. In the heavy press plant these billets may be as long as 58 in. Induction heaters are employed to preheat the billets to extrusion temperatures, ranging from 600 to 850° F. The induction heaters are capable of handling 4000 lb. per hr. and approximately 1 min. per in. of diameter is required to heat the billets.

The two 8000-ton presses generate their extrusion pressure through three hydraulic cylinders, each exerting 2700 tons. The maximum advance speed of the main ram is 50 ft. per min.

Heat treatment following extrusion may be done either in a vertical furnace suspended over a 70-ft. tank of water or in a horizontal furnace which has a quench tank capable of emitting 20,000 gal. of water a min. through a series of nozzles. The use of the horizontal furnace is most effective in heat treating the much longer, heavier and wider solid extrusions produced on the heavy presses.

A 750-ton stretcher and a 3,000,000 in. lb. detwister support the heavy presses to increase the physical properties of the final extrusions by minimizing residual stresses and to eliminate twists and distortions which may occur during the processing of the metal.

In the case of strategic aircraft sections, the most modern immersion inspection system whereby ultrasonic waves are passed through a water bath and thence through the extrusions to detect internal defects is employed.

Kaiser Aluminum employs approximately 1000 people at Halethorpe and will increase this number at the completion of their current expansion program. The combined facilities make up one of the most versatile extrusion operations in the East. **—Reported by G. M. Hinton for Baltimore Chapter.**

Clark Presents Handbooks at Ottawa

As Part of an Educational Program Designed to Stimulate Greater Interest in the Study of Metallurgy, the Ottawa Valley Chapter Recently Presented A.S.M. Metals Handbooks to Technical Schools and Engineering Colleges in Ottawa. The presentation took place at the National Officers Night Meeting when D. S. Clark, national president, talked on "Dynamic Properties of Metals". Shown, from left: Charles Satkevicius, representing the schools; Dr. Clark; G. M. Young, national vice-president; and J. K. Hurwitz, who made the presentation. (Reported by P. J. Todkill)

Discusses Metallurgical Aspects of Machinability

Speaker: George Watteman
Bethlehem Steel Co.

"Metallurgical Aspects of Machinability" was the subject of a talk delivered before the **Northeast Pennsylvania Chapter** by George Watteman, assistant metallurgical engineer, Bethlehem Steel Co.

Variables affecting cutting performances are estimated to run into millions. However, these figures which are raised to astronomical proportions, are of no practical value if we take into account the variations in the analysis of the steel being cut and the effect of the various phases in steelmaking, such as rolling, heat treatment, cold working, etc. Metallurgical control is essential if satisfactory machinability is to be attained. Mr. Watteman noted specific cases illustrating how increases in hardening elements will affect machinability.

Studies of chip sizes and characteristics, supplemented by color photographs, showed interesting information on machining properties and tool wear.

Microhardness tests are used to study metallurgical differences and the effect of elements such as nitrogen and boron on the various constituents of steel.**—Reported by John P. Jacobs for Northeast Pennsylvania Chapter.**

Discusses Advances in Special Metals

William H. Bleecker, Allegheny Ludlum Steel Corp., Cermet Division, Gave a Talk Entitled "Advancements in Carbide Materials" at a Meeting Held by Rochester Chapter. Shown are, from left: Ermanno A. Basilio; N. J. Finsterwalder, chairman; Mr. Bleecker; and educational chairman G. L. Cox

Speaker: William H. Bleecker
Allegheny Ludlum Steel Co.

At a recent meeting in **Rochester,** members heard a talk on "Advancements in Carbide Materials" by W. H. Bleecker, technical director of Allegheny Ludlum Steel Corp.'s Cermet Division.

The manufacture of cemented carbide was illustrated first by the use of a motion picture film. It was shown how the basic materials, tungsten and carbon, are mixed and fused together to form the tungsten carbides. After proper milling and sizing, the third element, cobalt, is added in amounts varying from 3 to 20% to form the finished cemented carbides.

Mr. Bleecker then illustrated how the strength of cemented carbides is much higher than would be expected from the individual components. High film strengths are responsible for the improved physical properties.

The three properties that are necessary to form a satisfactory cemented carbide are: 1. There should be some dissolving of the carbide in the binder metal; 2. this dissolving should not be excessive or a hard alloy phase would be formed; and 3. there should be no chemical reaction between the carbide material and binder metal.

Mr. Bleecker reviewed some of the latest developments in cemented carbide tools using other materials such as titanium and chromium carbides and titanium and chromium diborides. While all of these materials have desirable properties for certain applications, the tungsten carbide-cobalt material still has the best all-around properties. One recent development has been the control of the size of the tungsten carbide grains. The size of the grains determines to some extent the properties of the cemented carbides. The larger the carbide grain size, the lower the hardness, the smaller the grain size, the higher the hardness.

In summary, Mr. Bleecker stated that there had been a statistical improvement in cemented carbides in recent years. This has been accomplished by close factory control and giving in the long run a material that has proved statistically of better quality. He also stated that the greatest improvement in cemented carbides will be realized through closer cooperation between manufacturers and users, to insure that the proper grade is always used.—**Reported by R. E. Avery for Rochester.**

Terre Haute Members Tour General Motors Foundry

Speaker: V. Righter
General Motors Corp.

Members and friends of the **Terre Haute Chapter** were guests of the General Motor Corp.'s Danville, Ill., foundry for a dinner and plant tour.

Verne Righter, plant manager, greeted the group, explained the history and functions of Central Foundry and introduced the various departmental heads who guided the members on an interesting tour of the entire plant.

The Danville Foundry has been operating as a part of General Motor's Central Foundry Division since 1947. It employs approximately 2400 people and produces some 225,000 castings in a 16-hr. day. Castings of both malleable and gray iron are made and vary in size from 0.4 to 81 lb. One of the items of special interest is the shell molded, malleable iron crankshaft being made for Pontiac Division. Of the total production, 20% is sold outside of the corporation, the users include Ford Motor Co. and the Chrysler Corp.

Following the plant inspection, members of the staff remained on hand to answer questions and to discuss the many points of interest.—**Reported by G. R. Follis for the Terre Haute Chapter.**

Speaks on Metallurgy in Europe at Chattanooga

Speaker: Charles K. Donoho
American Cast Iron Pipe Co.

The **Chattanooga Chapter** heard a talk on "European Metallurgy Techniques" by Charles K. Donoho, chief metallurgist, American Cast Iron Pipe Co., at a recent meeting. Mr. Donoho just returned from a tour of England and the continent, where he made a study of the cast iron industry.

Due to the poor quality of raw materials available to European foundrymen, the methods of production have to be better than average to produce a high grade of cast iron, and in some progressive foundries they have gone beyond the United States in foundry equipment. Some of the interesting aspects of European foundry practice as compared to American practices reported by Mr. Donoho were: (a) the practice of having a blast furnace in connection with the foundry; and (b) construction of cupolas with walls lined with acid or basic slag, and constructed so that the slag can be changed in acidity while in operation for better quality metal. Their induction melting and vacuum degassing methods are also ahead of ours, Mr. Donoho reported. The method of adding magnesium under pressure to three-ton ladles to prevent volatilization is another European process he described.

Mr. Donoho's general summary of European research laboratories was that they excel in pure research of long-range value and in careful laboratory testing, but in practical shop methods and in service testing, they lag behind our laboratories.

Using slides to illustrate, Mr. Donoho then showed the properties of nodular cast iron as compared to ordinary cast iron and explained the effect of the addition of magnesium on the graphite. Since nodular cast iron is twice as strong as ordinary cast iron, wall thicknesses can be halved, which leads to weight reduction. He then showed examples of nodular cast iron castings in service and tests in actual life-size samples which tell much more about field service ability than small laboratory samples.—**Reported by J. H. McMinn for Chattanooga.**

Die Casting Panel Meets in Ontario

Members of the Panel on Die Casting Which Met Before the Ontario Chapter Included, From Left: D. C. Barber, Barber Die Casting Co. Ltd.; Dean Fry, Ontario Steel Products Ltd.; Jack Chambers, Aluminum Co. of Canada, Ltd.; Jim McVean, Hoover Co.; Jim Burgess, Dominion Die Casting Co.; and N. J. Clark, Barber Die Casting Co. Ltd. G. D. Fry moderated the panel

An excellent program was presented by the die casters section of the Automotive Parts Manufacturers Asciation before a meeting of the **Ontario Chapter.** It included a film entitled "Die Casting—How Else Would You Make It?"

A variety of die-cast products, ranging from cabinet door knobs and handles to complicated motor components, covering applications from hand power tools to airplane parts, was on display.

A number of technical charts pertaining to die casting, published by the Die-Casters Association, Inc., of New York, were also exhibited.

The film covered the actual die casting processes, showing the various methods now in use, as well as the handling and treatment of parts during manufacture. It further enlarged upon the scope of die casting applications, which, while quite considerable at present, still appear to have an even more important role in the future.

A panel of experts, including David C. Barber, president, Barber Die Casting Co. Ltd., N. J. Clark, sales manager, Barber Die Casting Co. Ltd., J. A. Burgess, vice-president, Dominion Die Casting Co. Ltd., J. Chambers, sales representative, Casting Division, Aluminum Co. of Canada Ltd., and J. A. McVean, sales manager, Die Casting Division, The Hoover Co., was introduced and moderated by G. D. Fry, vice-president, Schultz Die Casting Co. of Canada Ltd.

The panel answered questions from the floor on the subject of die casting during the technical session which extended well into the night, signifying the interest of the more than 100 members and guests attending.—**Reported by V. G. Behal for Ontario Chapter.**

Presents Discussion on Electroplating of Metals

Speaker: D. G. Foulke

Hanson-Van Winkle-Munning Co.

D. Gardner Foulke, Hanson-Van Winkle-Munning Co., spoke on "Electroplating of Metals" at a meeting in **Northeast Pennsylvania.**

Dr. Foulke described the basic plating cycles that are being used commercially and showed how these cycles varied with the type of base metal being plated and the type of soil that is removed prior to plating.

Ordinarily the cycle consists of a precleaning operation, anodic clean, acid dip, plate, etc., with the proper water rinses between each operation. In plating high carbon steel, smut removal is a problem, while in plating stainless, an activation step (eg., nickle-chloride strike), is necessary. Plating zinc die castings requires an acid dip and copper strike before plating and many combinations of anodic cleaners are used. Prior to cleaning, buffing, tumbling and sand blasting are resorted to to obtain proper surfaces.

One of the newer developments in the electroplating field is a levelling-type nickel bath which tends to level out irregularities in the base surface. Use of such solutions reduces or eliminates the need for buffing.

Dr. Foulke pointed out that the end use of the part being plated determines the type of plate and the deposit thickness. Some of the properties that may be required are corrosion resistance, wear, change of dimensions, prevention of carburization preparation for joining, forming, etc. Examples of plating baths and specifications that are used to obtain various engineering properties were described. A discussion of plating plant engineering including descriptions of sources of power, types of tanks used, drainage and exhaust systems and general materials of construction, illustrated with slides, concluded the talk.—**Reported by John P. Jacobs for Northeast Pennsylvania Chapter.**

Steelmaking Talk Presented at Peoria

A. G. Forrest, Chief Metallurgist, Republic Steel Corp., Chicago District, Presented a Talk Entitled "Steelmaking—Constitution and Properties" at a Meeting Held by the Peoria Chapter. From left are: Roy Kern, chief metallurgist, Allis-Chalmers Manufacturing Co.; Mr. Forrest; and A. L. La Masters, chairman of the chapter. (Reported by J. I. Ragee)

Speaks on Nondestructive Testing

Gerald H. Tenney, Los Alamos Scientific Laboratory, Spoke on "Better Quality Through Nondestructive Testing in the Metals Industry" at a Meeting of the Albuquerque Chapter. He surveyed the entire field of nondestructive testing, discussing the different methods, illustrating his talk with slides. Shown are, from left: D. W. Ballard, secretary; Dr. Tenney; and R. S. Lemm, chairman of the chapter. (Reported by C. E. Arthur)

Vacuum Melting Is Subject at Purdue

Speaker: James H. Moore
Vacuum Metals Corp.

"Vacuum Melting" was the subject discussed by James H. Moore, general manager, Vacuum Metals Corp., at a meeting of the **Purdue Chapter.**

Although not a new process, vacuum melting has been employed only recently in the United States. Serious consideration was being given this process at the end of the World War II. This was precipitated primarily by the demand for higher quality metals, particularly those of a higher alloy content and those to be used at elevated temperatures.

The inherent advantages of vacuum melting are more complete degassing, removal of inclusions and improved analytical control. Investigations have shown that certain alloys produced by this process have increased fatigue limits, more desirable impact properties and improved yield strengths. Some alloys previously considered to have little, if any, workability, have been found to be amenable to this property when produced by vacuum melting.

Mr. Moore described, with the aid of diagrams and photographs, two methods of vacuum melting and discussed the advantages and disadvantages of each. The two methods were the vacuum arc furnace and the vacuum induction furnace.

In the vacuum arc process, the charge is an electrode. The refined metal is collected in a cold mold. In this process, freezing problems, such as piping and segregation, are minimized. However, the end quality of the alloy must necessarily depend to a certain degree on the initial quality of the charge or electrode.

The vacuum induction process utilizes raw materials as the charge. During the cycle, H_2, N_2 and some of the more volatile metals are evolved from the melt. Consequently, when magnesium, manganese, zinc, etc., are desired in an alloy, they are made as late additions. Typical reactions occurring within a steel melt are those of carbon-oxygen, hydrogen-oxygen, and the reduction of oxides. The presence of inclusions is further reduced since no slag is present. During the cycle, unfavorable reductions of the furnace lining may occur. Insofar as the life of the furnace lining is concerned, however, mechanical failure is much more of a problem. Solidification of metal produced by the vacuum induction process is much the same and similar problems are encountered as with metal produced by air melting.

Of the two methods of vacuum melting, the greatest degree of refinement is available from the induction process.—**Reported by K. H. Schneck for Purdue.**

Clark Guest in Akron

Speaker: D. S. Clark
A.S.M. President

Donald S. Clark, national president A.S.M., was the guest speaker at the National Officers' Night meeting of the **Akron Chapter.** The title of his talk was "What Dynamic Laboratory Tests Of Metals Tell Us". Through a close study of impact test results, Dr. Clark pointed out the significance of the dynamic loading of metals and its relationship to engineering design and metallurgical application.

The coffee speaker, Anton de Sales Brasunas, director of the A.S.M.'s Metals Engineering Institute, discussed some of the highlights of the M.E.I. program for the coming year. —**Reported by Carl Dorosa for Akron Chapter.**

Philadelphia Brought Up-to-Date on Aluminum Alloy Developments

Speaker: G. M. Young
Aluminum Co. of Canada

G. M. Young, technical director of the Aluminum Co. of Canada and vice-president A.S.M., presented a talk on "Aluminum Alloy Development Up-to-Date" at the National Officers Night meeting of the **Philadelphia Chapter.**

Early laboratory studies produced aluminum about 1825. But it was not until 1854 that the first commercial quantities were made. Aluminum was then used for jewelry, helmets, sword and sabre sheaths, fine embroidery wire, surgical wire and optical instruments. Its pleasing color and corrosion resistance were desirable properties.

Early in its development, aluminum was alloyed with copper, silicon, boron, lead, zinc, tin and cadmium. The early results of alloys of zinc were most unsatisfactory. Aluminum-clad products with copper or brass cores were developed, with very good results.

In 1886 the electrolytic process for reducing alumina was developed. With this new method the price of aluminum was reduced greatly, encouraging further research.

Mr. Young traced the development of most of the aluminum alloys used today and discussed the advantages and disadvantages of each. Many alloys were discarded as new ones were developed. In some cases, the discarded alloys have come back into usage again. The casting of aluminum alloys was paralleled by developments of sheet and wire production. Heat treatable alloys followed and soon found great application in the aircraft industry. The use of aluminum in aircraft was predicted 40 years before man was able to fly.

As the price of aluminum was reduced over the years, more and more uses for it have been found and production continues to increase. Some freight cars have already been made of aluminum, the increased cost being offset by the light weight and greater payload. Aluminum has also been used in the food packaging industry and may give competition to the "tin can".—**Reported by Harold A. Foy for Philadelphia Chapter.**

Creative Thinking Cited As Necessity to Solve Problems—Make Decisions

Speaker: Harry N. Ghenn
American Viscose Corp.

The Junior Section of the **Philadelphia Chapter** enjoyed an informative discussion by Harry N. Ghenn, manager, jet and glass departments, American Viscose Corp., entitled "An Approach to Everyday Problem Solution and Decision Making" at a recently held meeting.

Mr. Ghenn discussed the shortage of engineers and technical personnel, and expressed the opinion that existing personnel could help to alleviate the shortage by becoming more efficient in creative thinking. Efficiency, in this case, could be defined as the ability to visualize the over-all problem, to analyze the problem, to search for a solution and, finally, to make a decision. A decision was defined as a choice of alternate means towards a final goal. Mr. Ghenn noted that some companies at the present time are offering courses in "creative thinking" to improve engineers' thinking and discover executive talent.

The first step presented under the formal procedure for problem solution and decision making is to find the problem, which is usually easy to do; it is necessary to recognize the problem and understand the need that is to be answered. The problem must be stated correctly, since many programs have been misguided by the fact that the true problem was not known—after the problem has been clearly defined, the search for the solution may be begun.

In searching for the solution, ideas and data should be accumulated and the trivia separated from the vital; the main cause should be defined and one's own as well as others' experiences searched for parallels. While searching, teamwork or committee work is sometimes necessary, and blocks to creative thinking must be eliminated. There are perceptual blocks that may be formed by faulty observation or cultural blocks, which latter may be described as resentment of change in tradition. Many times, management hires men to think but stifles their creative thinking by blocking any changes they might like to make in tradition.

After studying the information and data, the solutions should be evaluated and a decision made; action should then be formulated and executed promptly. It may be necessary occasionally to check the process or operation to determine whether the decision reached was the correct one.—**Reported by Willard L. Hunsberger for Philadelphia—Junior Section.**

Chevrolet-Tonawanda Tour Taken by Buffalo Members

Some 330,000 tie rod sockets, 30,000 crankshafts, and similar quantities of 20 other Chevrolet forgings for motors and axles are produced in a typical month at the newly established Chevrolet-Tonawanda Forge Division of the General Motors Corp. in Buffalo, N. Y. What it means to produce this quantity of high-quality steel forgings was explained and shown to the members of the **Buffalo Chapter,** during a plant tour taken recently.

The Chevrolet-Tonawanda Forge Division is one of the country's newer, modern forge shops. Its basic forge equipment consists of 14 upsetters, which have a capacity of from 2 to 6 in. diameter stock, and 14 fast-acting hydraulic presses, ranging from 800 to 6000 tons. These basic machines, along with auxiliary heating, trimming, cleaning and inspection equipment and material handling facilities, make possible the production figures indicated above.

The ground for this particular plant was broken early in 1954 and operations were begun late in 1955. The plant was built primarily to feed raw forgings into the Buffalo Motor and Axle Divisions of the Chevrolet Division, General Motors Corp., and to make use of the relatively good supply of quality steel which is available from local mills. Besides these two obvious economic considerations, the planning division of G.M. attempted to make the Chevrolet-Tonawanda Forge Division one of the country's most modern forge shops and thereby reduce parts costs. Plant layout, basic forge equipment and all the accessories to feed the presses and take the finished or semifinished product to the next area were designed, bought and laid out with efficiency as the prime objective.

The senior members of the chapter were amazed at the changes that have taken place in forge shop equipment and design during the past decade. Gone are the slow, repetitive stroke operations characteristic of the drop hammer and in their place is the one-squeeze stroke of the big hydropress. The junior members were amazed at the speed and efficiency of this entire operation that makes possible the processing of some 9000 tons of steel per month into finished quality automotive forgings.—**Reported by G. F. Kappelt for Buffalo.**

National Officers Visit Montreal

Donald S. Clark, National President A.S.M., Greets Arnold Boehm (Left), Chairman, While G. M. Young (Center), National Vice-President and Former Chairman of the Chapter, Adds His Best Wishes, During a Meeting of the Montreal Chapter. Dr. Clark presented a talk on "Yield Phenomenon in Low Carbon Steel". The national officers also brought the chapter up-to-date on headquarters activities and reported that 18 scholarships in metallurgy had been awarded to Canadian students for the current year

Cites Steelmaking Advances in York

Karl L. Fetters (Left), Assistant Vice-President, Youngstown Sheet and Tube Co., and National Trustee A.S.M., Who Presented a Talk on "Steelmaking" at York Chapter, Is Shown With Program Committeeman Ed Vitcha

Speaker: K. L. Fetters

Youngstown Sheet & Tube Co.

Members of **York Chapter** heard Karl L. Fetters, assistant vice-president, Youngstown Sheet and Tube Co., and national trustee A.S.M., give a comprehensive review of the reserve iron ore supplies in this country in a talk entitled "Steelmaking".

Dr. Fetters estimated that the importation of foreign ores, which today amounts to approximately 20% in demand, will have increased to about 37% by 1975, and will help in preserving our domestic resources. The improvements in beneficiation of low-grade ores will supplement the reserve of high-grade ores by an annual 40 million tons by 1970.

Dr. Fetters stated that, although the quality of scrap has deteriorated and ash and sulphur content of coal has increased, the improvements made in blast furnace and openhearth operations have increased the output by as much as 20% without the addition of new furnaces. Better charges from beneficiated ores, higher quality coke and the introduction of steam and oxygen into the blast are some of the improvements made in blast furnace operations. Openhearth efficiency has been improved by use of oxygen, roof jets to aid in decarburization, better refractory life and the use of bath pyrometers.

In summarizing, Dr. Fetters stated that chemical and physical technical developments, as well as the development of thinking along the lines of increased production methods, are jointly responsible for the present gains in steelmaking. Future benefits will be in research which will allow steel production to keep up with rising labor and material costs as well as deterioration of raw materials.—**Reported by J. L. Brown for York Chapter.**

Brittle Fracture in Large Forgings Discussed In N.W. Pennsylvania

Speaker: A. O. Schaefer

Past President A.S.M.

A. O. Schaefer, past-president A.S.M., talked on "Brittle Fracture of Large Forgings" at a meeting of the **Northwestern Pennsylvania Chapter** held recently.

Mr. Schaefer pointed out that brittle failures were common in all industries and in all types of metals and are not alone a characteristic of large forgings. However, after the advent of several large turbine failures in 1954, A.S.T.M. set up a Task Force Group to study this problem. Their immediate aim was to establish some criteria of evaluating brittle fracture and investigating the failures.

At first, there was a full-scale investigation of the inspection methods in our country and Europe. Out of these came more useful ultrasonic information so that guides could be set up and standardized.

Also, hydrogen, being termed a detrimental characteristic tending to embrittle steels, was thoroughly studied. As a result, several companies in this country have adapted vacuum casting techniques.

A number of tests for brittle fracture were investigated. It seemed pertinent that we must have a type test that would allow us to measure the susceptibility of brittle fracture of materials, particularly large sections. European methods were also reviewed. The notch slow bend, the drop weight test, and the Charpy transition ductility tests were all carefully checked to see if they could be used as a criteria of notched toughness. At present, Charpy transition temperature values are being used to evaluate brittle fracture characteristics.

In summarizing, Mr. Schaefer pointed out that the next phase of the Task Force Group work would be in research, to determine the cause of brittle fracture. This would deal with the very fundamentals of crack propagation in metals, and much effort and emphasis is being applied along these lines.—**Reported by George E. Danner for Northwestern Pennsylvania.**

Reports on Weld Defects—Causes and Cures—at Meeting in Cleveland

Speaker: H. R. Clauser

Materials and Methods

"Weld Defects—Their Causes and Cures" was the subject of a talk given by H. R. Clauser, editor, ***Materials and Methods***, at a meeting of the **Cleveland Chapter.**

Mr. Clauser approached the subject with a basic review of weld unsoundness. Getting a sound weld is still one of the toughest problems. In spite of the advances which have been made in machines and electrodes, the human element is always an important controlling factor. Not only the welder, but those responsible for edge preparation and fit-up, and the engineers who design and decide the filler metal, contribute to weld problems.

Key factors involved in getting a sound weld include the part itself, proper joint design (which affects the stress element), selection of the metal for weldability, proper electrode, quality of the base metal (internally and surface-wise), fit-up and edge preparation, and preparation of the back pass.

Mr. Clauser showed how radiography is used to test the soundness of welds, explaining how defects appear on the X-ray film. He illustrated the different kinds of cracks and described methods of avoiding them. He showed porosity caused by gas pockets or voids. How this type of defect affects weld quality was explained, with emphasis on surface cleanliness as a necessity for the prevention of porosity. Inclusions caused by oxides or by slag entrapment from the electrode coating as well as incomplete fusion were illustrated.

Mr. Clauser mentioned how a porous spot often starts a crack. Incomplete penetration and its causes were also explained. A weld defect, called "stubbing", was explained to be caused by a tired welder laying a piece of electrode in the weld and welding over it.

The speaker concluded with a description of the radiographs he used to illustrate his talk. A question and answer period followed the talk.—**Reported by J. J. Glubish for Cleveland Chapter.**

Calumet Briefed on Automation

R. W. Holman, Director, Control Mechanisms Development, U. S. Steel Corp., Spoke on "Automation as Related to Flat Rolled Products" at a Meeting of the Calumet Chapter. Pictured are, from left: H. C. Kaeff, technical chairman; Mr. Holman; and Phil Booth, chairman of the chapter

Speaker: R. W. Holman

U. S. Steel Corp.

"Automation as Applied to Flat Rolled Products" was the subject of a talk given before the **Calumet Chapter** by R. W. Holman, director, control mechanism development, Research and Technology Division, U. S. Steel Corp.

Automation as applied to flat products was defined as the act of making flat products automatically and continuously. It was further pointed out that the flat products industry made its really significant advance toward automation when the industry converted from hand hot mills and individual sheet processing to continuous processes producing materials in large coils. Various new developments were discussed, including automatic thickness control on cold reduction mills, the application of speed regulators and tension compensation to continuous hot strip mills. In addition, the electrolytic tinning line was described as the most highly automated process in a flat products plant and, in principle, was designed for almost continuous operation. New devices discussed for electrolytic tinning lines were coating thickness gages, radiation base weight gages, modern pin-hole detectors, sheared length measuring devices and automatic detection equipment for surface defects.

The discussion was closed on the thought that the progress toward automation flat products depends upon the operating people indicating their problems to the engineers and upon the ability of the engineers to design more and more complicated combinations of sensing, control and mechanical devices. — **Reported by J. W. Luoma for Calumet Chapter.**

Talks in Indianapolis on Properties of Cemented Oxides at Tool Material

Speaker: H. J. Siekmann

General Electric Co.

H. J. Siekmann, Metallurgical Products Department, General Electric Co., presented a lecture on the "Characteristics of Cemented Oxides as a Tool Material" at a meeting of the **Indianapolis Chapter.**

The most important problem affecting the cutting process is the temperature of the tool and work coupled with cutting speed. Mr. Siekmann presented a chart showing the typical tool interface as cutting speed is increased. This showed that as speed increased the temperature increased.

The effects of temperature on toolsteels are: (a) high carbon, the high temperatures soften tool; (b) high speed steel, which is an improvement over high carbon; (c) cast alloy, which will retain hardness at high speeds and temperatures; (d) carbides, which can be used at much higher speeds and temperatures than the others; and (e) recent tool materials, which are the improved carbides and the cemented oxides. The cemented oxides will maintain hardness at higher speeds and temperatures than others.

Cemented oxides are weaker than carbides. Carbides will take a tougher job than ceramics and will outperform them in the carbide speed range. The cemented oxides can be used to good advantage in the ultrahigh speeds and are excellent for light finishing cuts. The surface finish made by the cemented oxides is finer than that made by carbides.— **Reported by Dorothy Holbrook for Indianapolis Chapter.**

Statistics in the Steel Plant Topic in Notre Dame

Speaker: W. T. Rogers

U. S. Steel Corp.

At a recent meeting of the **Notre Dame Chapter** W. T. Rogers, National Tube Division of U. S. Steel Corp., gave a talk on the "Application of Statistical Methods in a Steel Plant".

Mr. Rogers' talk was centered around the use of statistical methods in the operation of a blast furnace. He explained multiple regression as applied to all the raw components going into the furnace. With National Tube's extensive work and accumulation of data, it is able to predict the estimated yield of pig iron per square foot of hearth area. This estimated yield compares very favorably with the actual production.— **Reported by R. C. Pocock for Notre Dame Chapter.**

Lectures on Cermets and Ceramics at Los Alamos

Speaker: L. D. Richardson

Wright Air Development Center

The **Los Alamos Chapter** was host to L. D. Richardson, chief of the technical development section, Wright Air Development Center, at a recent meeting.

In his talk, "Cermets, Ceramics and Metals", Mr. Richardson outlined the problems associated with aerodynamic applications of materials. Against this background he then discussed the development and evaluation of cermets, ceramics and alloys for service at extremely high temperatures. Discussion on refractory coatings for metals and the behavior of brittle-state materials was included in this talk.

The probability of greatly increased demands for high-temperature materials and testing facilities was recognized, and design and performance data were given for typical materials in both established and unusual applications.—**Reported by H. L. Brown for Los Alamos.**

A.S.M. spends $44.50 to service each member of the Society for a period of one year.

National President Guest in Muncie

Donald S. Clark, National President A.S.M., Was the Guest of the Muncie Chapter at the National Officers Night Meeting. He spoke on the "Propagation of Plastic Strain in Metals". Pictured are, from left: W. H. Charlesworth, chairman; Dr. Clark; and R. M. Mathews, program chairman

The **Muncie Chapter** heard Donald S. Clark, national president, speak at its National Officer's Night meeting, which also honored the past chairmen of the Chapter.

Dr. Clark, who gave the "coffee talk" in addition to his scheduled address, discussed the new national headquarters building, as well as the future plans for the Society, which include a metal institute to give further aid to metallurgists, an improved and more rapid method of processing technical papers submitted, and a future expansion of the student program to assure a continued and increasing number of the metallurgists for which the country has such an urgent need.

Program Chairman Bob Mathews introduced a number of guests from Caterpillar Tractor Co., and called the roll of past chairmen. Those able to be present were: Rodney G. Hayler (1932); Harry Bennett (1936 and 1955); Louis W. Murray (1942); Robert Peters (1934 and 1944); J. Dunlap McNair (1946); Gene Davis (1949); Dallas Lunsford (1950); Ted Hollingsworth (1952); and Paul Lewis (1956). Communications were read from others who were unable to attend due to location or business reasons.

Dr. Clark then presented his talk entitled "The Propagation of Plastic Strain in Metals".—**Reported by Robert R. Myers for Muncie.**

OBITUARIES

KEITH REEVES RODNEY, a director of Edgcomb Steel and Aluminum Corp., died Nov. 24 of a heart attack. He was 81.

Born in New Castle, Del., he graduated from Friend's School, Wilmington, in 1891. He later studied metallurgy at Drexel Institute and was associated with the steel industry all his life. For many years he was in charge of Midvale's heat treating and forging departments, later superintendent of the heat treating department of Winchester Arms, then chief metallurgist and foundry superintendent of Bullard Machine Tool Co.

He joined Edgcomb in 1926, starting in a sales capacity, later assuming duties as chief metallurgist. In 1948 he became a member of the board of directors. In 1951 he was made assistant secretary. He retired in May of this year but remained as a director. He was a member of the New Jersey Chapter.

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JAMES J. CALLAHAN, senior metallurgical engineer for the thermal products division of Alco Products, Inc., died recently after a long illness. Mr. Callahan, 61, had been associated with ALCO since 1917. A native of Little Falls, N.Y., he was a graduate of Rensselaer Polytechnic Institute.

New Student Group Formed

A Student Group has recently been organized at North Carolina State College, aided and encouraged by members of the Carolinas Chapter, with which it is affiliated.

Officers installed include I. Barry Choate, chairman; John J. DuPlessis, vice-chairman; Cedric D. Beachem, secretary-treasurer; and W. W. Austin, head of the department of mineral industries, faculty advisor.

Set Tri-Chapter Meeting

The Tri-Chapter Meeting of the **Cincinnati, Columbus and Dayton Chapters** is scheduled for Apr. 11, 1957. Theme of the meeting will be "Newer Processes in Metallurgy". W. J. Koshuba, chairman of the Tri-Chapter meeting committee, is now completing plans for the sessions, tentatively scheduled as follows:

"Recent Developments in Atmosphere Control in Gas Carburizing", by O. E. Cullen, chief metallurgist, Surface Combustion Co.

"Extrusion of Metals", by G. Moudry, chief metallurgist, Harvey Aluminum Co.

"Vacuum Technology in Metallurgy", by F. N. Darmara, general manager, Metals Division, Utica Drop Forge and Tool Co.

"Kellogg Electric Ingot Process", by R. K. Hopkins, manager, electric products department, M. W. Kellogg Co.

"High-Temperature Brazing Alloys and Processes", by Sam Whalen, president, Aerobraze Inc.

"Effect of Processing on High-Temperature Materials", by V. Krivibok, International Nickel Co.

Technical sessions will be held in the General Electric Evendale plant and a tour of the facilities will be included in the meeting. A dinner will be held in the evening at the Hartwell Country Club and it is tentatively planned that Dr. Krivibok will present a lecture following the dinner.

Gives Properties of Vacuum-Melted Metals at Notre Dame

Speaker: A. M. Aksoy
Vacuum Metals Corp.

Members of the **Notre Dame Chapter** heard Dr. A. M. Aksoy, chief metallurgist, Vacuum Metals Corp., speak on "Properties of Vacuum-Melted Materials" at a recently held meeting.

Following a brief history of the origin and development of the vacuum melting process, Dr. Aksoy went on to describe the beneficial properties obtained by this process. These included improvements in fatigue properties, ductility, ratio of transverse to longitudinal strength, notch impact strength and rupture strength. In addition, it is possible to obtain better electrical and magnetic properties by use of this process.

Some of these properties are due to the high purity and low gas content, and others are due to the fact that alloys are obtainable by this method which are impossible by conventional methods.—**Reported by R. C. Pocock for Notre Dame.**

IMPORTANT MEETINGS *for March*

Mar. 6-8—Pressed Metal Institute. Annual Spring Technical Meeting, Hotel Carter, Cleveland. (H. A. Daschner, Managing Director P.M.I., 3673 Lee Rd., Cleveland 20).

Mar. 11-15—Nuclear Congress. Convention Hall, Philadelphia. (Coordinator: Engineers Joint Council, 29 West 39th St., New York 18).

Mar. 14-15—National Industrial Conference, Ben Franklin Hotel, Philadelphia. (H. S. Briggs, Secretary, 460 Park Ave., New York 22).

Mar. 17-19—Steel Founders' Society of America. Annual Meeting, Drake Hotel, Chicago. (G. K. Dreher, Secretary S.F.S.A., 606 Terminal Tower, Cleveland 13).

Mar. 18-21—American Society of Mechanical Engineers. Gas Turbine Power Division, Sheraton Cadillac Hotel, Detroit. (C. E. Davies, Secretary A.S.M.E., 29 West 39th St., New York 18).

Mar. 25-27 — American Society of Tool Engineers. Annual Meeting, Shamrock Hotel, Houston, Tex. (H. E. Conrad, Secretary A.S.T.E., 10700 Puritan Ave., Detroit 21).

Mar. 25-29 — American Society for Metals. Western Metal Congress and Exposition, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles. (W. H. Eisenman, Secretary A.S.M., 7301 Euclid Ave., Cleveland)

Mar. 25-29—Society for Nondestructive Testing. Annual Meeting, Ambassador Hotel, Los Angeles. (P. D. Johnson, Secretary S.N.T., 1109 Hinman Ave., Evanston, Ill.).

At Joint ASM-ASTM Meeting in Rome

Rudolph A. Schatzel, President A.S.T.M. and Vice-President and Director of Engineering, Rome Cable Corp., Was Honored at a Joint A.S.M.-A.S.T.M. Meeting Held in Rome. He spoke on "Materials for Power". Pictured are, from left: Truman S. Fuller, past president A.S.T.M.; Robert J. Painter, executive secretary A.S.T.M.; Dr. Schatzel; Harry J. Hamjian, vice-chairman, Rome Chapter A.S.M.; and W. C. Neagley, chairman Rome Chapter

Speaker: Rudolph A. Schatzel
Rome Cable Corp.

The **Rome Chapter** was host to a recent joint dinner and meeting with the American Society for Testing Materials in recognition of Rudolph A. Schatzel, president of A.S.T.M. Dr. Schatzel, vice-president and director of engineering, Rome Cable Corp., has distinguished himself in research and development work on electrical cable insulations, particularly rubber and thermoplastics.

At the meeting, he discussed "Materials for Power", with emphasis on the role of standards in relation to materials for power transmission.

Power today performs an increasing diversity of tasks in serving the individual, such as shaving, or to operate a steel mill or light a city. Dependence on this servant grows day by day, and, no matter what task it performs, the channel by which that power is made useful is through wire.

Higher voltage insulated cables have become a necessity in the United States and within the next ten years, most utilities expect to double their generating capacity. This will require concentration of larger blocks of power and their distribution at higher voltages all along the line from the generator to the service outlet in the home. The demand for reliability of service, operation at higher temperatures, conservation of space and operation at higher voltages, requires a restudy of materials, methods and design.

In referring to the various types of insulating materials used for various types of wire, Dr. Schatzel pointed out that the chemist has done pretty well in keeping up with the engineer in making available a wide choice, and that the expanding technology has not reached the peak where ingenuity is exhausted.

Robert J. Painter, executive secretary A.S.T.M., emphasized that standards in industry are not static but dynamic. Standards require constant research to provide progress but similarly research requires standards to implement discoveries and provide guide lines.

Technical Papers Invited for A.S.M. Transactions

The Transactions Committee of the A.S.M. is now receiving technical papers for consideration for publication in the 1958 Transactions and possible presentation before the next national meeting of the Society to be held in Chicago, Nov. 4 to 8, 1957.

Many of the papers approved by the Committee will be scheduled for presentation on the technical program of the 39th National Metal Congress and Exposition and the 2nd World Metallurgical Congress.

Papers may be submitted any time up to Apr. 15, 1957, for consideration for presentation at this convention. The selection of approved papers for the convention technical program will be made early in May 1957. Manuscripts may be submitted any time during the year and upon acceptance by the Transactions Committee will be processed immediately for preprinting. All papers accepted will be preprinted and made available to any members of the Society requesting them. However, the printing of an accepted paper does not necessarily infer that it will be presented at the convention. Under a new plan of the Society, preprinting of accepted papers will be done quarterly. Notification of their availability will be published in *Metals Review*.

Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Should it be your intention to submit a paper, please notify A.S.M. A copy of the booklet entitled "Suggestions to Authors in the Preparation of Technical Papers" will be gladly forwarded. This booklet may help considerably in the preparation of line drawings and illustrations.

TECHNICAL PROGRAM

WESTERN METAL CONGRESS AND EXPOSITION

Los Angeles, Mar. 25-29, 1957

COOPERATING SOCIETIES

American Ceramic Society
American Chemical Society
American Electroplaters Society
American Foundrymen's Society
American Institute of Electrical Engineers
American Institute of Mining, Metallurgical and Petroleum Engineers—Metals Branch
American Materials Handling Society
American Ordnance Association
American Rocket Society
American Society of Civil Engineers
American Society of Heating and Air Conditioning Engineers
American Society of Lubrication Engineers
American Society of Mechanical Engineers
American Society for Metals
American Society for Quality Control
American Society of Refrigerating Engineers
American Society of Safety Engineers
American Society for Testing Materials
American Society of Tool Engineers
American Welding Society
California Society of Professional Engineers
Electrical Maintenance Engineers Association
Industrial Heating Equipment Association
Institute of the Aeronautical Sciences
Instrument Society of America
Pacific Coast Gas Association
Purchasing Agents Association of Los Angeles
Society of Aircraft Materials and Process Engineers
Society of Applied Industrial Engineering
Society of Automotive Engineers
Society of Carbide Engineers
Society for Industrial Packaging and Materials Handling Engineers
Society for Nondestructive Testing
Society of Plastics Engineers
Society of Women Engineers
Southern California Industrial Safety Society
Structural Engineers Association of Southern California
Western Society of Gear Engineers

AMERICAN SOCIETY FOR METALS

Monday
Mar. 25
9:00 a.m.

ADVANCED METHODS OF MACHINING AND METAL REMOVAL

Panel Chairman: Manuel C. Sanz, Chief, Materials Research, North American Aviation, Inc.

Ultrasonic Machining, by Donald A. Benbow, Sheffield-Western Sales Corp.

High-Speed Machining, by Kenneth L. Wilson, North American Aviation, Inc.

Ceramic Cutting, by Paul Havener, Carborundum Co.

Electric Spark Discharge Machining, by Fred L. Regnier, North American Aviation, Inc.

Chem-Milling, by Hugh H. Muller, Northrop Aircraft Corp.

2:00 p.m.

SPECIAL FORMING TECHNIQUES

Panel Chairman: Gilbert A. Moudry, Chief Metallurgist, Harvey Machine Co., Inc.

Impact Extrusions for Aircraft Structural Applications, by Gilbert A. Moudry, Harvey Machine Co., Inc.

Fabrication of Metals for Nuclear Reactor Cores, by F. R. Lorenz, Westinghouse Electric Corp.

New Developments in Impact Extrusions, by Raymond A. Quadt, Hunter Douglas Corp.

Tuesday
Mar. 26

INDUSTRIAL HEATING EQUIPMENT ASSOCIATION

(Joint Program with the A.S.M.)

9:00 a.m.

BRAZING AND SINTERING

Chairman: E. E. Staples

Furnace Brazing, by H. W. Webber, General Electric Co.

Salt Bath Brazing, by Leon Rosseau, Ajax Electric Co.

Induction Brazing and Soldering, by W. E. Benninghoff, Ohio Crankshaft Co.

Furnace Sintering of Ceramics, Metals and Metallizing, by R. L. Harper, Harper Electric Furnace Corp.

2:00 p.m.

SHORT-TIME ELEVATED TEMPERATURE TESTING OF METALS

Panel Chairman: Alan V. Levy, Supervisor, Marquardt Aircraft Co.

Problems Connected With Testing Materials for Short Times at Elevated Temperatures, by Alan V. Levy, Marquardt Aircraft Co.

Strength of Metals Undergoing Rapid Heating, by Warren Smith and Allen Robinson, U. S. Naval Ordnance Test Station

Fluid Analogy to Aerodynamic Heating, a Testing Method Used in the Development of Elevated Temperature Structural Criteria for Application to Guided Missiles, by T. C. McGill, Convair Division of General Dynamics Corp.

Short-Time Creep Properties of Structural Sheet Metals, by John A. Van Echo, Battelle Memorial Institute.

Effect of Variations in Time at Temperature and Strain Rate on the Tensile Properties of Structural Metals at Elevated Temperatures, by J. R. Kattus, Southern Research Institute.

Wednesday
Mar. 27
9:00 a.m.

METALS AND METALLURGY IN ELECTRONICS

Panel Chairman: Blair L. Molander, Group Leader, Metallurgy, North American Aviation, Inc.

Fabrication of Semiconductors in Transistor Production, by William V. Wright, Pacific Semiconductors.

Processing and Purification of Silicon for Semiconductor Uses, by D. K. Hartman, General Electric Co.

Germanium for Semiconductors, by John Milek, North American Aviation, Inc.

Zone Melting and Zone Purification of Semiconductor Materials, by Walter Pollitt, Hughes Aircraft Corp.

2:00 p.m.

AIRCRAFT ALLOYS FOR THERMAL FLIGHT

Panel Chairman: A. H. Petersen, Group Engineer, Design, Lockheed Aircraft Corp.

Requirements Peculiar to Aircraft Design, by Leo Schapiro, Douglas Aircraft Corp.

Material and Processing Requirements, by F. R. Kostoch, North American Aviation, Inc.

Heat Treatable Corrosion Resistant Steels for Thermal Flight, by R. B. Gunia, U. S. Steel Corp.

Tool and Die Steels for Thermal Flight, by G. A. Roberts, Vanadium Alloys Steel Co.

Superalloys for Airframe Structural Members, by F. S. Badger, Haynes-Stellite Co.

Titanium Alloys for Thermal Flight, by R. I. Jaffee, Battelle Memorial Institute.

Thursday
Mar. 28
9:00 a.m.

CORROSION AND METAL PROTECTION IN THE PETROLEUM AND CHEMICAL INDUSTRIES

Panel Chairman: Martin Michaud, Materials Supervisor, Union Oil Co. of California

Cost of Corrosion and the Economics of Material Selection, by Martin Michaud, Union Oil Co. of California

Importance of Inspection in Corrosion Control, by E. H. Tandy, Standard Oil Co. of California.

Metallic Coating for the Protection of Steel, by C. H. Sample, International Nickel Co.

Nonmetallic Coatings in the Petroleum and Chemical Industry, by Lester Morris, Coating and Fiberglass Research Co.

Cathodic Protection, Principles and Applications, by L. L. Whiteneck, Pipeline Coating.

2:00 p.m.

TITANIUM

Panel Chairman: Gordon A. Fairbairn, Supervisor, North American Aviation, Inc.

Forgings, by J. J. Russ, Steel Improvement and Forge Co.

Extrusions, by Eric Berg, Harvey Machine Co., Inc.

Castings, by Frank Caputo, Oregon Metallurgical Corp.

Heat Treatment, by L. S. Busch, Mallory-Sharon Titanium Corp.

Welding, by Russ Meredith, North American Aviation, Inc.

New Alloys, by H. D. Kessler, Titanium Metals Corp.

SOCIETY FOR NONDESTRUCTIVE TESTING

Monday
Mar. 25

EDUCATIONAL SESSION

Chairman: Maurice J. Curtis, U. S. Naval Ordnance Test Station

8:00 a.m. Registration opens

10:00 a.m. Welcome, by Richard F. Holste, President S.N.T., X-Ray Products Corp.

10:05 a.m. Orientation, by Harvey W. Hill, Assistant Chief, Quality Control, Douglas Aircraft

10:35 a.m. Question and Answer Period

10:45 a.m. "Immersed Ultrasonic Techniques", by Cleo Webb, Research Analyst, Douglas Aircraft

11:15 a.m. Question and Answer Period

11:25 a.m. "Magnetic Particle Inspection", by A. E. Morse, Research Engineer, North American Aviation

11:55 a.m. Question and Answer Period

12:05 p.m. Lunch

1:30 p.m. "Basic Principles of Eddy Currents", by Hugo L. Libbry, Senior Engineer, Testing Methods, Hanford Atomic Products Operation (Paper will be read by Ronald S. Paul, Manager, Testing Methods)

2:00 p.m. Question and Answer Period

2:10 p.m. "Visible and Fluorescent Penetrant Inspection", by Robert G. Strother, Magnaflux Corp.

2:40 p.m. Question and Answer Period

2:50 p.m. "Nucleonic Gaging Methods", by J. E. Reider, Industrial Nucleonics Corp.

3:20 p.m. Question and Answer Period

3:30 p.m. "High Voltage Parameters", by James H. Bly, High Voltage Engineering

4:00 p.m. Question and Answer Period

4:10 p.m. "Education in Nondestructive Testing", by R. C. McMaster, Ohio State University

7:30 p.m. Visit to the Don Bosco Technical High School Nondestructive Testing Facility . . . . Discussion of **Nondestructive Testing in Education,** by W. R. Varney, previously of California Institute of Technology, now with Cal-Tech, Los Angeles, and Father Pena, Don Bosco Technical High School

Tuesday
Mar. 26
8:45 a.m.

NONDESTRUCTIVE TESTING FOR THE AIRCRAFT INDUSTRIES

Chairman: R. E. Kleint, North American Aviation, Inc.

Co-Chairman: M. R. Jackson, Convair Division, General Dynamics Corp.

Welcoming Address, by Richard F. Holste, National President S.N.T.

Statistical Methods Applied to Ultrasonic Inspection, by M. J. Bratt, General Electric Co.

Hardness Tensile Relationships for High-Strength 7075 Aluminum Alloys, by G. B. Mathers and R. E. Kleint, North American Aviation, Inc.

Ultrasonic Flaw Plotting, by Benson Carlin, Alcar Instruments, Inc.

New Eddy Current Equipment for Flaw Detection, Alloy Identification and Determination of Metal Properties, by Richard Hochschild, American Testing and Control Co.

Flaw Evaluation of Ultrasonics, by William C. Hitt, Douglas Aircraft Co.

Magnetic Particle Inspection Using Water Suspendible Pastes, by V. I. E. Weigand and E. H. Honerkamp, General Electric Co.

2:00 p.m.

NONDESTRUCTIVE TESTING WITH ISOTOPES

Chairman: Dana E. Elliot, Los Alamos Scientific Laboratory

Co-Chairman: D. W. Ballard, Sandia Corp.

A.E.C.'s Relation to the Industrial Atom, by Robert F. Barker, U. S. Atomic Energy Commission.

Cesium-137, a Versatile Radiographic Tool, by M. L. Rhoten and S. A. Wenk, Battelle Memorial Institute.

Evaluation of the Application of Thulium-170 to Industrial Radiography, by D. E. Elliott and James W. Dutli, Los Alamos Scientific Laboratory.

Atomic Energy in Quality Control of Hermetically Sealed Parts, by C. W. Reed, Reed-Curtis Nuclear Industries, Inc. (Paper to be presented by Theodore J. Smith.)

Gamma Radiography of Light Metals, by Eric T. Clark, Technical Operations, Inc.

Wednesday
Mar. 27
9:00 a.m.

RADIOGRAPHY AND FLUORESCENT PENETRANTS

Chairman: Wallace J. Erichsen, Westinghouse Electric Corp.

Co-Chairman: C. R. Mikesell, Aerojet General Corp.

Large Source Cobalt in Radiography, by C. A. Karrer, Crucible Steel Casting Co.

Use of Multiple Film Techniques to Speed Industrial Radiographic Examinations, by Ralph E. Turner, Eastman Kodak Co.

Refinements in Radiographic Techniques, by H. S. Wyckoff, Triplett and Barton, Inc.

Brightness of Fluorescent Penetrants, Its Measurement and Influence in Detecting Defects, by Donald W. Parker and J. T. Schmidt, Magnaflux Corp.

Advantages and Limitations of Flexible Fluorescent Screens in Ship Radiography, by K. G. Roberts, Naval Research, Dockyard Laboratory, Halifax, N. S. (Paper to be presented by C. R. Mikesell.)

2:00 p.m.

HONORS SESSION

Chairman: R. F. Holste, National President S.N.T.

Co-Chairman: National Officers and Directors S.N.T.

DuPont Award, Sponsored by S.N.T. and E. I. Du Pont de Nemours and Co., Inc. Recipient—Eric A. Kolm, Raytheon Manufacturing Co.

Lester Honor Lecture, Sponsored by S.N.T. Recipient—Edgar O. Dixon (Posthumously), Presentation to William Dixon, his son.

Tribute: Edward J. Foley, Ladish Co.

Award Presentation: Donald Erdman, Sperry Products, Inc.

Intermission

NONDESTRUCTIVE TESTING IN INDUSTRY

Chairman: John Battema, Ferro-Spec Laboratory, Inc.

Co-Chairman: Kermit Skeie, Magnaflux Corp.

Corrosion Inspection With Ultrasound, by Donald C. Erdman, Sperry Products, Inc.

Tensile Properties of Porosity-Graded 195 Alloy, by I. J. Feinberg, Naval Ordnance Laboratory.

Calibration Techniques for Reflectoscope Inspection, by H. E. Van Valkenburg, Sperry Products, Inc.

Special Film Presentation, directed by George H. Prudden, Lockheed Aircraft Co.

5:00 p.m.

SPECIAL DELEGATES MEETING

Chairman: Richard F. Holste, National President S.N.T.

Co-Chairmen: National Officers and Directors S.N.T.

Thursday
Mar. 28
9:00 a.m.

NONDESTRUCTIVE TESTING IN THE NUCLEAR ENERGY FIELD

Chairman: W. J. McGonnagle, Argonne National Laboratory.

Co-Chairman: J. J. Droher, North American Aviation, Inc.

Immersed Ultrasonic Inspection of Pipe and Large Tubing, by R. B. Oliver and J. K. White, Oak Ridge National Laboratory.

Radiography of Materials Used in the Nuclear Energy Field, by J. W. Dutli and D. E. Grimm, Los Alamos Scientific Laboratory.

Application of Lamb Waves in Ultrasonic Testing, by D. C. Worlton, General Electric Co.

Nondestructive Testing of Material for Nuclear Reactor Use, by O. R. Carpenter, Babcock & Wilcox Co.

Measurement of the Uranium Content of Argonaut-Type Fuel Elements, by W. J. McGonnagle and G. E. Bradley, Argonne National Laboratory.

2:00 p.m.

NONDESTRUCTIVE TESTING IN QUALITY CONTROL

Chairman: W. Stump, Dow Chemical Co.

Co-Chairman: R. W. Buchanan, University of Denver

Accelerated Life Tests, by H. G. Romig, Summers Gyroscope Co.

Use of Gamma Radiation for Density Measurement, by P. E. Ohmart, Ohmart Corp.

Reference Wedge X-Ray Gage, by Stanley Bernstein, General Electric Co.

Selection of Frequency for Eddy Current Testing, by B. H. Robinson, Magnaflux Corp.

Ultrasonic Resonance Equipment for Automatic Recording, Sorting and Controlling, by P. K. Bloch, Branson Instruments, Inc.

AMERICAN WELDING SOCIETY

Monday
Mar. 25
12:00 noon

Kick-Off Luncheon

Technical Program Chairman: Charles W. Conconnon, Sales Manager, Basco Inc.

Luncheon Speaker: J. J. Chile, National President A.W.S., Director of Research, A. O. Smith Corp.

2:30 p.m.

ROLE OF WELDING IN INDUSTRIAL ADVANCEMENT

Welding Codes—Stimulant or Stumbling Block, by T. B. Jefferson, Editor, *Welding Engineer*

Tuesday
Mar. 26
9:00 a.m.

AIRCRAFT AND ROCKETRY

Chairman: Mario Ochieano, Lockheed Aircraft Co.

Co-Chairman: George Foster, Air Reduction Pacific Co.

Supervisor: Harlan Meredith, Airline Welding and Engineering Co.

Recent Developments in Magnetic Force Welding, by Jack Funk, Precision Welder and Flexopress Corp.

Inert - Gas, Consumable - Electrode Welding of Aluminum Alloys in Liquid Aircraft Rockets, by Walter S. Tenner, U. S. Naval Ordnance Test Station, and Paul T. Barnes, U. S. Naval Test Station.

Resistance Welding Titanium Alloy Structures, by William R. Gain and Howard E. Woodward, Boeing Airplane Co.

2:00 p.m.

AIRCRAFT AND ROCKETRY

Chairman: Leo West, Douglas Aircraft Co.

Co-Chairman: Howard Eubank, Convair Division, General Dynamics Corp.

Supervisor: Bruce Baird, North American Aviation Inc.

Resistance Welding Controls Using Counter Tubes, by J. J. Riley, Taylor-Winfield Corp.

Stress Corrosion of Titanium Weldments, by William S. Arter, North American Aviation, Inc.

Vacuum Brazing of Sandwich Structures, by G. Jewett Crites, Engineering Consultant, El Segundo, Calif.

Wednesday
Mar. 27
9:00 a.m.

Chairman: Russell Graves, Fluor Corp.

Co-Chairman: Francis Redman, Southwestern Engineering Co.

Supervisor: M. K. McEniry, National Cylinder Gas Co.

Welding for Nuclear Pumping Applications, by Frank R. Drahos, Bryon Jackson Co.

Ultra-High-Strength Weld Metal for Aircraft Fabrication, by D. C. Smith, Harnischfeger Corp.

An Evaluation of Filler Materials for Use on High-Strength Low-Alloy Steels, by Frank G. Harkins, Solar Aircraft Co.

Weld Roll Planishing, the Weld Helper, by Harlan Meredith, Airline Welding and Engineering Co.

2:00 p.m.

Chairman: H. E. Evans, Associated Piping and Engineering Co.

Co-Chairman: J. L. Taylor, Superior Tank and Construction Co.

Today's Field Welding of Pressure Piping in the Refinery, Power and Pipeline Industries, by A. M. Croswell, Bechtel Corp.

Inert-Gas-Shielded-Arc Welding of the Aluminum Alloys, by Paul Dickerson, Aluminum Co. of America

Weldability of High-Temperature Alloys, by R. P. Culbertson, Haynes Stellite Co.

Thursday
Mar. 28
9:00 a.m.

Chairman: Leo Gatzek, Bendix Aviation Corp.

Supervisor: Frank Soady, Air Reduction Pacific Co.

Welding of Light-Gage Materials, by T. McElrath, Linde Air Products Co.

Evaluation of Hardfacing Materials, by Dave Rankin, Rankin Manufacturing Co.

A New CO_2 Welding Process, by A. F. Chouinard and R. T. Monroe, National Cylinder Gas Co.

Tool and Die Welding With Inert-Gas, Metallic Arc and Atomic-Hydrogen Process, by Patrick S. Doyen, Welding Equipment and Supply Co.

2:00 p.m.

Chairman: A. B. Bennett, Solar Aircraft Co.

Co-Chairman: J. Porter, Aerojet General Corp.

High-Temperature Atmosphere Silver Brazing, by A. M. Setapen, Handy and Harman Co.

Selection of the Proper Inert-Gas-Shielded-Arc Welding Process, by C. B. Robinson, Air Reduction Pacific Co.

Inert-Gas Welding of Nickel and High-Nickel Alloys, by K. M. Spicer, International Nickel Co.

Friday
Mar. 29
9:30 a.m.

Chairman: Art Williams, Consolidated Western Steel Co.

Co-Chairman: Charles Zwissler, Kaiser Steel Corp.

Supervisor: Cam Perry, Absco, Inc.

Use of Iron Powder in Arc Welding Electrodes, by Richard K. Lee, Alloy Rods Co.

Study of Causes of Weld Metal Cracking in High-Strength Steel, by Glen Faulkner, Battelle Memorial Institute

Constant Voltage-Type Welders and Their Applications, by L. P. Henderson, M & T Welding Products Corp.

AMERICAN INSTITUTE OF MINING, METALLURGICAL AND PETROLEUM ENGINEERS

Tuesday
Mar. 26
9:00 a.m.

ULTRA HIGH TEMPERATURE MATERIALS

Panel Chairman: Pol Duwez, California Institute of Technology

Vice-Chairman: J. A. Brown, Aerojet-General Corp.

Performance of Materials at Elevated Temperatures for Aircraft and Missile Applications, by Alan V. Levy, Marquardt Aircraft Co.

Role of Molybdenum in Tomorrow's Missiles, by Robert R. Freeman, Climax Molybdenum Co.

Sintered Carbides and Cermets for High-Temperature Service, by John C. Redmond, Kennametal Inc.

Graphite as a High-Temperature Material, by J. E. Hove, Atomics International Division, North American Aviation, Inc.

Wednesday
Mar. 27
9:00 a.m.

ALLOYS FOR FUTURE AIRFRAMES

Panel Chairman: C. W. Funk, Aerojet-General Corp.

Vice-Chairman: A. H. Peterson, Lockheed Aircraft Corp.

Some Metallurgical Problems in Fabrication of High-Temperature Airframes, by Fred Baisch, Boeing Airplane Co.

Welding Problems on Precipitation Hardening Stainless Steels, by George E. Linnert, Armco Steel Corp.

Conservation of Nickel in High-Temperature Alloys, by E. E. Reynolds, Allegheny Ludlum Steel Corp.

Thursday
Mar. 28
9:00 a.m.

LIGHT ALLOYS FOR AIRFRAMES

Panel Chairman: Harold H. Block, AiResearch Corp.

Vice-Chairman: Don R. Mathews, Hughes Aircraft Co.

Aluminum Alloys for Elevated Temperature Service, by Wayne A. Reinsch, North American Aviation, Inc.

Investigation of Depressive Deformation as a Means of Effecting Relief of Residual Stresses in High Strength Aluminum Alloys, by R. E. Klient and F. G. Jannay, North American Aviation, Inc.

Magnesium Alloys for Airframes, by F. Keith Lampson, Marquardt Aircraft Co.

Titanium Conference—Western Metal Congress

Ambassador Hotel, Los Angeles, March 25-29, 1957

Program plans are now complete for the A.S.M. Titanium Conference at the Ambassador Hotel, Los Angeles, Mar. 25-29. The five-day meeting, arranged by the Metals Engineering Institute, will provide ample opportunity for informal discussion periods during panel sessions as well as after individual lectures.

Registrants will receive complete texts or abstracts of the talks delivered, together with home study material from the M.E.I. correspondence course on Titanium now being prepared under the direction of Walter M. Finlay of Rem-Cru Titanium, Inc. These reprints will not be generally available after the conference and are intended only for distribution to registrants.

The conference program is as follows:

Monday, Mar. 25

Presiding: Walter L. Finlay, Vice-President, Rem-Cru Titanium, Inc., Midland, Pa.

8:00 a.m. **Registration:** (Also Sunday evening)

9:00 a.m. **Welcome:** Donald S. Clark, President A.S.M., California Institute of Technology

9:15 a.m. **Titanium Progress to Date** by Harry B. Goodwin, Battelle Memorial Institute, Titanium Metallurgical Laboratory, Columbus, Ohio

10:00 a.m. **Today's Uses and Design Criteria**

In Piloted Airframes, by S. R. Carpenter, Supervisor, Producibility, Convair, San Diego, Calif.

In Missiles, by A. T. Mocium, Section Head, Missile Development Division, North American Aviation, Inc., Downey, Calif.

In Turbo-Jet Engines, by A. W. F. Green, Technical Assistant to Executive Engineer, Allison Division, General Motors Corp., Indianapolis, Ind.

In Pratt & Whitney J-57 Jet Engine, by W. H. Sharp, Metallurgical Engineer, Pratt & Whitney Aircraft, East Hartford, Conn.

In Army and Navy Applications, by A. F. Jones, Chief, Materials Utilization Division, Ordnance Materials Research Office, Watertown Arsenal, Watertown, Mass.

In Civilian Applications, by L. J. Barron, Specialty Products Section, Pigments Dept., E. I. du Pont de Nemours & Co., Wilmington, Del.

12:30 p.m. **Group Luncheon**

2:00 p.m. **Titanium Riveted Fasteners,** by Harry Brenner, Director of Engineering, Olympic Screw & Rivet Corp., Downey, Calif.

2:30 p.m. **Practicability of Titanium Alloy Bolts,** by J. A. Van Hamersveld, General Supervisor, Producibility Engineering, Northrop Aircraft, Inc., Hawthorne, Calif.

3:15 p.m. **Pickling, Degreasing and Abrasive Cleaning,** by Walter H. Bishop, Chief Process Engineer, Mallory-Sharon Titanium Corp., Niles, Ohio

4:00 p.m. **Salt Bath Descaling,** by Walter H. Bishop, Mallory-Sharon Titanium Corp., Niles, Ohio

Tuesday, Mar. 26

Presiding: John H. Garrett, Executive Secretary, Coordinating Committee on Materials, Office of Assistant Secretary of Defense

9:00 a.m. **Blanking and Sheet Metal Forming,** by W. A. Mays, Group Leader, Metallurgical Products Development Laboratory, and G. J. Matey, Special Tool Engineer, North American Aviation, Inc., Los Angeles

10:30 a.m. **Forming of Extrusions and Bars,** by G. A. Moudry, Harvey Machine Co., Torrance, Calif.

11:00 a.m. **Stretch and Compression Forming,** by Cyril Bath, President, or F. J. Phillips, Sales Manager, Cyril Bath Co., Solon, Ohio

11:40 a.m. **Stress Relief, Annealing, Reactions With Atmosphere,** by Daniel J. Maykuth, Assistant Chief, Nonferrous Physical Metallurgy Division, Battelle Memorial Institute, Columbus, Ohio

12:30 p.m. **Group Luncheon**

2:00 p.m. **Panel on Forming**

Moderator: August Bringewald, Project Manager, Republic Aviation, Long Island, N. Y.

Panel Members: W. A. Mays, G. J. Matey, G. A. Moudry, Irvin Wilson, Cyril Bath, H. O. Mattes, Field Metallurgist, Republic Steel, Canton, Ohio, and L. A. Best, Douglas Aircraft, Santa Monica, Calif.

Wednesday, Mar. 27

MACHINING

Presiding: E. J. Krabacher, Senior Research Engineer, Cincinnati Milling Machine Co.

9:00 a.m. **Milling and Contour Cutting,** by Gordon C. Campbell, Chief, Manufacturing Research Section, Boeing Airplane Co., Seattle, Wash.

10:00 a.m. **Drilling and Reaming,** by F. A. Reed, Staff Superintendent, Aviation Gas Turbine Division, Westinghouse Electric Corp., Kansas City, Mo.

11:00 a.m. **Single Point Cutting,** by S. H. Flanagan, Convair, San Diego, Calif.

12:00 noon. **Grinding of Titanium,** by L. C. Hays, Staff Industrial Engineer, Thompson Products Co., Cleveland, Ohio

12:30 p.m. **Group Luncheon**

2:00 p.m. **Chem-Mill Process,** by Manuel C. Sanz, Chief, Materials Research, Missile Development Division, North American Aviation, Inc., Downey, Calif.

2:30 p.m. **Panel on Machining**

Moderator: E. J. Krabacher, Senior Research Engineer, Cincinnati Milling Machine Co.

Panel Members: L. B. Stearns, Chief Engineer, U. S. Chemical Milling Corp., Manhattan Beach, Calif., Dillon Evers, Associate Director of Research, Mallory-Sharon, Niles, Ohio, G. C. Campbell, F. A. Reed, S. H. Flanagan, L. C. Hays, and M. C. Sanz

Thursday, Mar. 28

WELDING AND BRAZING

Presiding: E. W. Cawthorne, West Coast Representative, Titanium Metallurgical Lab., BMI, Downey, Calif.

9:00 a.m. **Arc Welding Titanium,** by Glenn Faulkner, Assistant Chief, Metals Joining Division, Battelle Memorial Institute, Columbus, Ohio

10:00 a.m. **Flash Welding,** by R. D. Libert, Supervisor, Research and Development, Aeronautical Division, A. O. Smith Co., Milwaukee, Wis.

11:00 a.m. **Brazing and Soldering,** by Harry Schwartzbart, Supervisor, Welding Research, Armour Research Foundation, Chicago, Ill.

11:45 a.m. **Influence of Impurities,** by D. H. Barbour, Assistant Manager, Products and Process Development Dept., Electro Metallurgical Co., Niagara Falls, N. Y.

12:30 p.m. **Group Luncheon**

2:00 p.m. **Los Angeles Chapter A.S.M. Panel on Titanium.**

Friday, Mar. 29

A LOOK INTO THE FUTURE

Presiding: Leo Schapiro, Douglas Aircraft Co., Santa Monica, Calif.

9:00 a.m. **Present Limitations and Future Potentials of Titanium Castings,** by A. H. Roberson, U. S. Bureau of Mines, Albany, Ore.

9:45 a.m. **Present Limitations and Future Potentials of Titanium Powder Metallurgy,** by A. D. Schwope, Manager, Materials Division, Clevite Research Center, Cleveland, Ohio

10:45 a.m. **Present Limitations and Future Potentials of Titanium Forgings,** by J. J. Russ, Technical Director, Steel Improvement and Forge Co., Cleveland, Ohio

11:30 a.m. **Present Status and Future Potential of Titanium Tubing,** by T. M. Krebs, Metallurgist, Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa.

12:30 p.m. **Group Luncheon**

2:00 p.m. **Integrated Sheet Rolling Program,** by N. E. Promisel, Chief Metallurgist, Navy Dept., Bureau of Aeronautics, Washington, D. C.

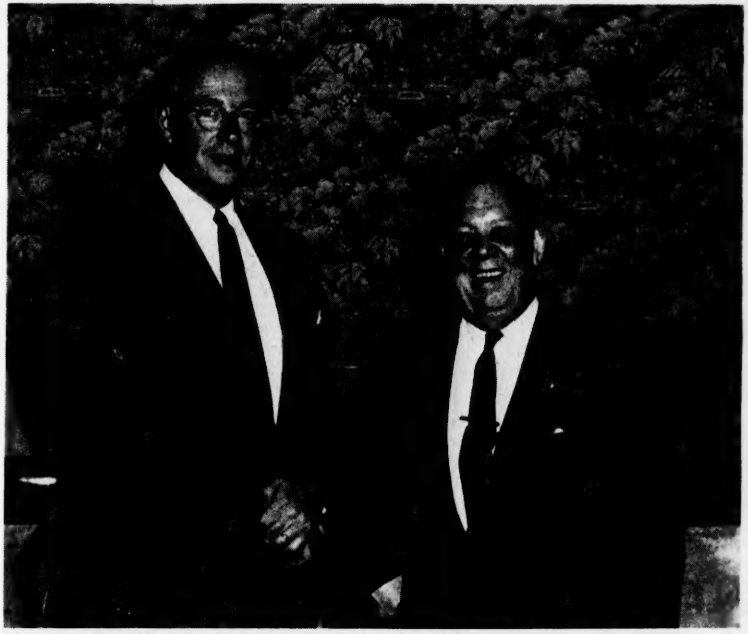
2:30 p.m. **Producers' Research and Development Programs,** by Lee S. Busch, Director of Research, Mallory - Sharon, Niles, Ohio, H. D. Kessler, Supervisor, Metallurgical Research Division, TMCA, Henderson, Nev., W. L. Finlay, Vice-President, Rem-Cru Titanium, Midland, Pa., and S. W. Poole, Director, Titanium Research, Republic Steel Corp., Canton, Ohio.

4:15 p.m. **Outlook for Titanium in the Aircraft Industry,** by T. H. Gray, Assistant Chief Metallurgist, Boeing Airplane Co., Seattle, Wash.

4:45 p.m. **Closing Remarks,** by W. H. Eisenman, National Secretary A.S.M.

As attendance will necessarily be limited to about 100, it is suggested that registrations be made as soon as possible. A convenient registration form appears on page 61.

Oak Ridge Holds Joint ASM-AWS Meeting



Vincent T. Malcolm (Right), Consultant and Former Director of Research, Chapman Valve Co., Presented a Talk on the "Welding of Austenitic Stainless Steels" at a Joint Meeting of Oak Ridge Chapters A.S.M. and A.W.S. He is shown with E. C. Miller, past chairman of both A.S.M. and A.W.S.

Speaker: V. T. Malcolm
Chapman Valve Co.

The **Oak Ridge Chapter** and the local section of the American Welding Society presented a joint dinner meeting at which Vincent T. Malcolm presented a talk on the "Welding of Austenitic Stainless Steels". Mr. Malcolm is a consultant and former director of research for the Chapman Valve Co.

The speaker pointed out that the basic problem of failure in welds and adjacent to the welds has not been sufficiently resolved.

In order to determine the suitability of a steel for high-temperature service, environment, heating and cooling rates, temperature distribution, stress, and the rates of stress application, in addition to the metallurgical factors already present, must be considered.

Several examples of the use of austenitic stainless steels in the oil, chemical and steam power industries were cited and the pressure and temperature conditions under which they operate were given.

The development of welding procedures was traced, welding problems were discussed and the effects of stabilizing element additions were evaluated.

In conclusion, Mr. Malcolm discussed "weld decay" in austenitic stainless steels and the various factors which might account for it.—**Reported by A. Goldman for Oak Ridge Chapter.**

Talk on Fabrication of Aluminum Given at Jackson

Speaker: J. A. Ketchum
Kaiser Aluminum & Chemical Corp.

"Aluminum Fabrication" was the subject of a talk given by J. A. Ketchum, Kaiser Aluminum and Chemical Corp., at a meeting of the **Jackson Chapter.** A movie "Take a Look at Tomorrow", which showed the processing of aluminum from mine to finished products, was also shown.

Throughout the talk, the importance of the metallurgist in aluminum processing was stressed. Of particular importance is the selection of the proper heat treatment process, Mr. Ketchum said.

In 1946 the United States used 410,000 tons of processed aluminum, in 1956 the use had risen to 1,743,000 tons and, by 1960, Mr. Ketchum stated, the industry expects to supply 2,526,000 tons. At the present time the aluminum industry is supplying about 70% of any primary electrical conductor materials. By 1965 it is expected that this figure will have increased by 400%. In 1956 about 32 lb. of aluminum was used in each automobile manufactured and this figure is expected to rise to about 95 lb. per car by 1965.

At the present time there are three major producers of aluminum in the United States. In order of the amount of metal produced they are Alcoa, Reynolds and Kaiser.

Metallurgical News and Developments

Devoted to News in the Metals Field of Special Interest to Students and Others

A Department of *Metals Review,* published by the
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Satellite Platform—The firing and launching platform for the earth's first artificial satellite has been designed, built and installed by the Loewy-Hydropress Division of Baldwin-Lima-Hamilton Corp.

Rare Earths Research—A contract for fundamental research in the field of the rare earths has been awarded by the Air Research & Development Command, Wright-Patterson Field, to Horizons Inc.

Nuclear Center—A National Institute for Nuclear Science and Techniques has been established in Paris. The Institute will offer, in collaboration with universities, specialized training in the nuclear sciences and techniques for graduate engineers and technicians, maintain permanent liaison with schools of medicine and pharmacy, engineers' colleges, scientific organizations and the French Atomic Energy Commission, and facilitate relations with research laboratories and industrial enterprises.

Join Forces—Sylvania Electric Products Inc. and Corning Glass Works have announced a proposal to form a jointly owned company for the purpose of expanded research, development and production activities in the atomic energy field. The company will be called Sylvania-Corning Nuclear Corp.

Scholarship Aid—A scholarship designed to encourage liberal arts students to acquire an engineering education has been established at Illinois Institute of Technology. The full-tuition grant, initiated by International Nickel Co., Inc., will become available for the 1957-58 school year. It will be awarded to students who transfer to Illinois Tech from one of the 29 liberal arts colleges participating in a combined study plan at I.I.T.

Metal Sandwiches—A wide range of metal laminates with a true metallurgical bond has been announced by Bridgeport Brass Co. and is available to designers and manufacturers. The laminates are combinations of two or three metals permanently and metallurgically bonded together to form one "sandwich". The combined metals offer physical, chemical and mechanical properties that are impossible to get in a single metal.

Research Institute Formed—Union Carbide & Carbon Corp. has announced that the Union Carbide Research Institute has been formed to engage in basic scientific research. It will be located near Tarrytown, N. Y., and will be under the administration of Augustus Kinzel, vice-president of Union Carbide. E. R. Jette, formerly head of the chemistry and metallurgy division at Los Alamos Scientific Laboratory, has been appointed director of the Institute. Facilities will be completed by the Spring of 1958.

Nuclear Reactor Course—In an expansion of its offerings in the field of nuclear energy, the Polytechnic Institute of Brooklyn is presenting the first course in the East on the metallurgy of nuclear power reactor materials. The course will be offered during the Spring semester to graduate students and professionals working in the field.

Doehler Award—The American Die Casting Institute, 366 Madison Ave., New York 17, has announced that the annual Doehler Award for the advancement of the die casting industry or to the art of die casting will be awarded again this year to any individual, group of individuals, educational institution, technical or scientific society for outstanding contributions. Nominations and supporting papers or other material will be accepted up to Apr. 15.

New Die Steel—A tougher die steel for forging recently developed high-temperature alloys has been announced by Vanadium-Alloys Steel Co. The new hot work die steel, Jet Forge, is a high-chromium steel which has given excellent performance records during a recent period of on-the-job testing in plants manufacturing jet engine blades and buckets.

Instruments Congress—The International Congress and Exhibition of Measuring Instrumentation and Automation (IKAMA) is scheduled for Nov. 2 to 10 in Dusseldorf, Germany. The Congress is being handled by Nordwestdeutsche Ausstellungs-Gesellschaft m.b.h., Dusseldorf.

Nuclear Tech Conference—The second annual Industrial Nuclear Technology Conference will be held in Chicago from May 14 to 16, 1957, at the Museum of Science and Industry. The Conference is sponsored by Armour Research Foundation and Nucleonics Magazine.

Metalworking Advancement—A process for making wrought products from metal powders has been developed by research engineers at Sintercast Corp. of America, Yonkers, N. Y. Known as Sinterwrought, this process eliminates many of the disadvantages of conventional powder metallurgy techniques and of conventional casting and metalworking. The known advantages of powder metallurgy—the ability to "tailor" compositions of metallic mixtures to specific requirements—are achieved in shapes such as strips, bars and tubes of lengths hitherto unobtainable by powder metallurgy.

Metallurgy Collection—J. H. Villard Inc., 175 Fifth Ave., New York, has announced that the concern has assembled an important collection of old engravings, mostly of the 18th century, featuring scenes of the metal industries, such as smelting, refining, rolling, fabricating, etc. The collection can be seen, preferably by appointment, and some of the pictures are for sale or can be rented for publicity purposes.

Discount Offered on Documentation Book

The proceedings of the 1956 Western Reserve Conference on the Practical Utilization of Recorded Knowledge have been published in book form by Reinhold Publishing Corp. The title of the book is "Documentation in Action", edited by Jesse H. Shera, Allen Kent and James W. Perry. Retail price is $10.00.

Since the American Society for Metals was one of the co-sponsors of the conference, the publishers are offering a 20% discount to all A.S.M. members. The book contains several contributions concerning A.S.M. activities in the field of documentation and information research. To make certain that the discount is granted orders should be sent to: Center for Documentation and Communication Research, School of Library Science, Western Reserve University, Cleveland 6, Ohio.

Stresses Importance of Quality Control in Plane Manufacture at Atlanta

Speaker: H. C. Christen
Lockheed Aircraft Co.

The **Atlanta Chapter** heard a lecture by Harvey C. Christen, director of quality control for the Lockheed Aircraft Co., on "Quality Control and Manufacturing".

Mr. Christen's talk, accompanied by a film, stressed the importance of quality control in production of modern aircraft, which, for high-altitude flight, are essentially pressure vessels. He described the catastrophic failure of the British "Comet" jet airliners and the extensive search and tests made to trace the failure to a fatigue crack initiating in a window frame. He stressed the fact that design and fabrication procedures are very critical for modern aircraft and practices, such as crack stopping by drilling, are not accurate and cannot be tolerated. Edge effects in the location of rivet holes have also become accentuated.

The Lockheed Co. has undertaken an extensive training program of its employees to point out dangerous practices and to improve product reliability. They have stressed the catastrophic results of the failure of even a single item in flight.

Lockheed gives its components and planes extensive static loading and fatigue tests for product improvement; the training of its employees has been undertaken to point up the workers' importance to the completed product and to instruct them to be conscientious in every step of the fabrication of a part on assembly. Efforts in this direction promise to bear much fruit in the future with regard to team spirit, loyalty, pride in their product, and resultant product dependability and economy.

One of the most uneconomic and costly phases of aircraft building is the replacement of defective parts or assemblies turned up by the extensive series of inspections and tests to which each plane is submitted.

It was further pointed out that the advent of nuclear powered planes means that many parts become virtually inaccessible once the reactor is activated and that repairs or replacements will be highly uneconomical or impossible. The design and the part must be virtually perfect. Quality control is now pointing toward this goal through an extensive reliability program.—**Reported by James Johnson for Atlanta.**

A.S.M. owns and operates the National Metal Exposition, the largest annual industrial exposition in America.

Chicago Chapters Honor President

Donald S. Clark, National President A.S.M., Addressed a Joint Meeting of the Chicago and the Chicago-Western Chapters. His talk was entitled "What Do Dynamic Laboratory Tests of Metals Tell Us". Present were, from left: D. R. Edgerton, Chicago chairman; Dr. Clark; C. E. Swartz, national trustee; A. E. Koctur, Chicago-Western chairman; and B. S. Myers, Chicago vice-chairman. (Reported by E. J. Lewnard for Chicago)

Explains 100% Sinter Burden at Gary Works at Calumet Chapter Meeting

Speaker: R. W. Sundquist
U. S. Steel Corp.

The use and economics of "100% Sinter Burden at Gary Works" were the subject of a talk given by R. W. Sundquist, blast furnace division superintendent, U. S. Steel Corp., at a meeting of the **Calumet Chapter.**

Although relatively new in this country, the practicality of using high sinter burdens had been proven some time ago in Europe, its adoption there being due to the lack of good metallurgical coke. The figures shown by Mr. Sundquist indicated that extremely good coke rates were obtained by the Europeans in their small furnaces.

While good coke is not a problem here, the changing physical properties of the present ore supply whetted the interest of U. S. Steel Corp., and early in 1953 it decided to make a trial run on a furnace at Gary Works, No. 12 furnace being selected. Although the data obtained from the European furnaces could not be applied directly to the conditions which prevailed here, the gradual changeover from ore to 100% sinter went off smoothly. The difficulties experienced by the Swedish operators with respect to cold iron and low carbon contents were not in evidence here, and the furnace operated trouble-free for six months. Periodic hanging began at that time, and although some relief was obtained by raising the blast heat, hanging continued to occur. An investigation of outside wall temperature was made and indicated a band of scabbing build-up from partially fused sinter. Removal of the scab was finally accomplished by changing the burden to heavy scrap and coke, the latter being added in such a manner as to force the blast to hug the wall. This resulted in higher wall temperatures with subsequent melting away of the scab.

The end results of the wall build-up and the attending hangs were such as to drastically reduce the over-all efficiency of the run. In addition, sinter quality gradually dropped off as the good ore fines were replaced by run-of-the-mine dust, thereby causing day-to-day inconsistencies and resulting in a further lowering in production rates. Nevertheless, at the end of the nine months trial, the coke rate of No. 12 furnace averaged out to be only 1367 as compared to 1677 for a furnace of equal size and condition and running on a standard ore and coke burden. Disregarding the last three months of the test, it was shown that No. 12 furnace produced 19.1% more iron than the average of all the other furnaces, with a coke rate lower by 18.1%.

Mr. Sundquist pointed out that the success of this single run was sufficient to bring about a tremendous increase in the plant sintering capacity of the iron producing plants of U. S. Steel. He stated, however, that as long as good ores are available, it is unlikely that furnaces on production will exceed a sinter content of 70%, since the efficiency of the process evidently levels off at that point. — **Reported by J. W. Luoma for Calumet.**

Meet Your Chapter Chairman

INLAND EMPIRE

DALLAS S. BENNETT, general manager and vice-president, Rainway Manufacturing Co., was born in Carbon County, Mont. He attended Lower Columbia Junior College, Washington Technical Institute and Washington University, majoring in civil engineering. Following college he was employed as a construction engineer for the Bureau of Yards and Docks at Kodiak, Alaska. Upon the conclusion of this work he transferred to the U. S. Engineers at Fairbanks. He specialized in pre-stressed concrete structures and cold weather concrete work. He served with the 84th Infantry Division in Europe in World War II.

Upon leaving the service, he became interested in irrigation engineering and product design, and worked for a firm in Portland, Ore., becoming production manager. He entered business for himself in the present company, which manufactures agricultural irrigation equipment for the national and world markets, in 1950.

Mr. Bennett is vice-president of the national Sprinkler Irrigation Association, and has served on its board of directors. He is past secretary and board member of the Spokane Valley Rotary Club, has served as a trustee in the Presbyterian Church, and has been active in Boy Scout work. He is married, has two children, a girl and a boy. His hobbies and interests outside of his field of work are fishing and hunting.

HARTFORD

EDWARD L. BARTHOLOMEW, JR., professor of mechanical engineering, University of Connecticut, was born in Wareham, Mass., and attended Massachusetts Institute of Technology, where he received a B.S. degree in mechanical engineering in 1937, M.S. in mechanical engineering in 1942 and Sc.D. in physical metallurgy in 1951. He was co-captain of the wrestling team at M.I.T. in 1937. Dr. Bartholomew was on the teaching staff at M.I.T. for 12 years before joining the staff at the University of Connecticut.

He has been active in ordnance research, on flame hardening of armor plate and metallurgical investigation of enemy material. He is active in technical and social organizations and a director of First Ironworks Association, Inc.

Ed is married and has four children. His main relaxation and sport is fishing.

BALTIMORE

GODFREY A. STEMPLE, a native of Wyatt, West Va., is a graduate of West Virginia University and Johns Hopkins University. He participated in track and pole vaulting in high school. His first job after college was in the power sales department for an electric utility, and subsequent jobs included road construction and electric construction, and six and one-half years in a cold strip steel mill. He is presently director of the metallurgical laboratory for Baltimore Gas & Electric Co., also in charge of nondestructive testing.

Mr. Stemple is married and has one stepdaughter. He is active in his church's men's club and is fond of fishing in his spare time.

NORTHWESTERN PENNSYLVANIA

GORDON D. KIMPEL, a native of the Pittsburgh area, graduated from Carnegie Institute of Technology in 1939 with a B.S. degree in metallurgy. After two years with U. S. Steel at its Clairton plant, he served with the U. S. Army in the Pittsburgh Ordnance District for five years during World War II. Returning to industry, he was metallurgical consultant for Lovell Manufacturing Co. in Erie for eight years until recently when he transferred to White & Rupert, in the same city, as a salesman.

Gordon has two children, a girl 12 and boy 7. At home he likes to put things together in his basement workshop, or add an extension to the house. While at Carnegie he was a member of the student Kiltie Band and he now marches with the Shrine Band in Erie.

ALBUQUERQUE

ROBERT S. LEMM, manager of the electronics and standards department at Sandia Corp., was born in Montpelier, Idaho. He graduated from Michigan College of Mining and Technology, and also attended other educational institutions for degrees in metallurgy and mechanics.

Subsequent jobs included work on refrigeration, in mechanical engineering and electronics engineering before coming to his present job.

Bob has two sons and a daughter, and one grandson. He is a member of several technical societies and is a life member of the Glendale, Calif., Lapidary and Gem Society. He claims metallurgy, gemology, mineralogy and lapidary take up all of his time. He is a colonel, aide de camp for the governor of New Mexico.

FORT WAYNE

GENE A. WARWICK, advanced development specialist for metallic materials, General Electric Co., is a native of Toledo, Ohio, and a graduate of the University of Toledo.

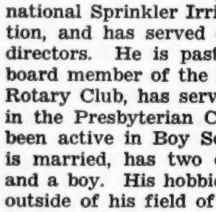
Gene is married and has three children. He is a member of the Bethlehem Lutheran Church, the General Electric Supervisor's Club, and has served his chapter A.S.M. in various capacities before becoming chairman. Golf, baseball and photography are his hobbies. Gene served in the U. S. Naval Reserve from 1944 to 1946 on active duty and was a member of the Reserve from 1946 to 1949, on inactive duty.

BUFFALO

MATTHEW N. HAYES was born in Rochester, and attended Massachusetts Institute of Technology and the University of Buffalo. He was active in soccer and track while at college. Background includes work as laboratory assistant, chemist, metallurgist, assistant plant engineer and production manager, and he is presently a materials and process engineer for Westinghouse Electric Corp.

Matt is married, has no children. His hobbies are golf, music and radio, and he is also active in the M.I.T. Alumni Association of Buffalo.

G. A. Warwick



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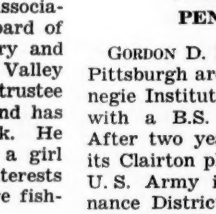

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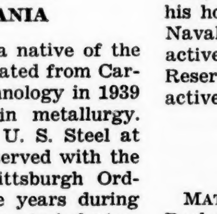
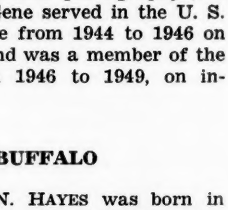


D. S. Bennett



IN RETROSPECT

The Recommended Practice Committee in 1925 approved two reports as tentative recommended practices. One of these, on carburizing of gears, was prepared under the chairmanship of F. C. RAAB of Brown-Lipe-Chapin Co., (now retired). The second, on the carburizing and heat treatment of camshafts, was prepared by a committee under the chairmanship of E. H. STILWILL of Dodge Bros. (also retired).

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The winter sectional meeting of the Society held in Buffalo in January 1926 followed the standard policy for such meetings—a few technical papers, ample time for plant inspections, a meeting of the board of directors and an opportunity for them to become acquainted with personnel in different sections of the country.

♦ ♦ ♦

At this meeting the board elected two men to honorary membership, both since deceased. They were CHARLES M. SCHWAB, chairman of the board of Bethlehem Steel Co., and Judge ELBERT H. GARY, chairman of the board of United States Steel Corp.

Predicts Extensive Use Of Aluminum in New Autos

Speaker: J. H. Dunn

Aluminum Co. of America

J. H. Dunn, manager development division, Cleveland plant, Aluminum Co. of America, spoke at a meeting of the **Canton-Massillon Chapter** on "Aluminum in Modern Automobiles".

Mr. Dunn's opening remarks dealt with the tremendous growth of the aluminum industry since 1939. Actually, a ten-fold expansion in this short period has placed aluminum second only to steel in annual production.

The automotive industry's use of aluminum is a major contribution to this outstanding growth. In 1950, for example, the average American automobile contained 12 lb. of aluminum, whereas in 1956, 35 lb. were used. Since 1955, aluminum alloy piston pins are standard equipment on all passenger car engines. To allow for the higher coefficient of thermal expansion of aluminum, the piston heads are round but the tapered skirts are elliptical. Color slides were shown to illustrate how the elliptical skirts become round in the close tolerance assembly when the engine attains its normal operating temperature.

Aluminum die castings also play an important role in the automotive field. After extensive research involving finite stress analyses, the Nash automobile used the first aluminum die casting, a clutch housing. Presently most of the new cars are using aluminum clutch housings very successfully. In the Nash, for instance, it was pointed out that aluminum die castings are 25% stronger in shear, 10% stronger in bend, have 100% better fatigue life, cost 15% less and involve a weight reduction of 25% over permanent mold castings. Both methods of casting are being used successfully and economically.

Aluminum plaster mold castings are made to ± 0.0005-in. tolerance. Such were used on the Packard ultramatic torque converter.

Automobile radiators are an attractive challenge to the aluminum industry. Much research is being conducted to overcome the present corrosion problems. Cathodic protection appears the most promising solution. Type AISI 3003 aluminum alloy will pit under radiator service conditions. However, this analysis, when cathodically protected, shows little or no such corrosion. The aluminum metal strip with a special alloy coating is known as Alclad. This material is readily brazed.

The 1956 Cadillac Eldorado contains aluminum parts totaling 192 lb. These include the forged chromium plated spoked wheels, and the gold colored anodized grill, hood ornament, emblem, pistons and clutch housing.

In conclusion, Mr. Dunn pointed to the expected 40% increase in automotive applications in 1959. Among others, these applications include brake drums, cylinder heads and cylinder blocks.—**Reported by J. E. Fogarty for Canton-Massillon.**

Digest Service Announced

The Technical Digest Service, Inc., is now publishing monthly digests and digest translations of articles on production, design, development and research from journals of the world. The material is translated, condensed and evaluated by practicing metallurgists and presented in a format designed for quick and easy use.

E. S. Machlin, professor at Columbia University, edits the Technical Digest Service with the aid of an advisory board of editors. The service covers foundry, forging, sheet metal practice, wire and rod practice, powder metallurgy, welding, joining and metals refining, and additional subject series drafted to meet special needs of subscribing companies will be made available, as well as consulting services.

For descriptive brochure, write to: Technical Digest Service, Inc., 122 East 55 St., New York 22.

Discusses Lead and Its Alloys

Herbert E. Howe, Research Metallurgist, American Smelting & Refining Co., Federated Metals Division, Spoke on "Lead and Its Alloys" at a Recent Meeting Held in Montreal. Shown are, from left: Mr. Howe; G. F. Norman, publicity committee chairman; Arnold H. Boehm, chapter chairman; and K. W. Shaw, vice-chairman. (Photograph by E. Bermingham)

Speaker: H. E. Howe

American Smelting & Refining Co.

Herbert E. Howe, research metallurgist, American Smelting & Refining Co., Federated Metals Division, spoke on "Lead and its Alloys" at a meeting of the **Montreal Chapter.**

His talk dealt with mechanical properties and their significance for designing, and some unusual low melting alloys of lead and their unique physical properties.

Mr. Howe stressed the importance of the duration of the load on the mechanical properties, pointing out that tests such as creep and fatigue are used in evaluating lead alloys. Results from creep testing over a period of two decades were used to illustrate the effect of the time factor. Unusual dimensional changes which take place in certain low melting alloys and their applications were discussed. The points were brought out more vividly by slides showing results of tests conducted over a period of years at the American Smelting and Refining Research Center at Plainfield, N. J.—**Reported by G. F. Norman for Montreal.**

Talks on Tool and Die Developments

"Modern Developments in Tool and Die Steels" Were Discussed by S. G. Fletcher, Latrobe Steel Co., in Rochester. Shown are, from left: Dr. Fletcher; N. J. Finsterwalder, chairman; L. C. Kimpal, past chairman

Speaker: S. G. Fletcher

Latrobe Steel Co.

The **Rochester Chapter** heard Stewart G. Fletcher, director of metallurgy, Latrobe Steel Co., discuss "Modern Developments in Tool and Die Steels" at a recent meeting.

Dr. Fletcher feels that the improvements in tool and die steels can be classified into three activities. They are improved toolsteel composition, improved heat treating techniques and procedures, and improved steelmaking practices and quality control.

One improvement in steel composition has been the introduction of the free machining toolsteels accomplished by the addition of sulphur. Sulphur is added in a manner so that the sulphides are similar in size to the carbides. This greatly improves the machinability but does not adversely affect the physical properties, particularly the impact properties. Tests have indicated that the sulphides are probably chromium-vanadium sulphides. Lead and selenium have been tried but have not produced good free machining toolsteels.

The high-vanadium toolsteels are becoming increasingly popular. Toolsteels with 2% or more vanadium have high hardness and excellent resistance to abrasion. It is interesting to note that the vanadium carbides formed when vanadium is present in amounts greater than 1% are harder than tungsten carbides.

The precipitation hardening type die steels are finding increased use, particularly for plastic molding dies. The main disadvantage to this steel is the high cost.

Dr. Fletcher has noticed in the last ten years a marked improvement in the quality of the work produced by most heat treating shops. He feels that this improvement results, to a large measure, from the wider use of technical data made available since the war. Of particular use has been data predicting the growth and distortion that can be expected after each particular heat treatment.

Two factors have greatly improved the mill control of toolsteels. One is the development of rapid analytical methods of determining steel composition. This makes possible heats of much closer chemistry control. The other is the use of ultrasonic inspection techniques to detect internal defects in billets and bars before finished processing. In addition the control of carbide segregation in high speed toolsteels has markedly improved the performance of these steels.—**Reported by R. E. Avery for Rochester Chapter.**

Describes Heat Treating Properties of Tool and Die Steel at Golden Gate

Speaker: E. E. Lull

Crucible Steel Co. of America

E. E. Lull of Crucible Steel Co. of America described to members of the **Golden Gate Chapter** the growth and shrinkage characteristics of tool and die steels during heat treatment in a talk entitled "The Metal Workers' Omnibus".

Mr. Lull, utilizing a dilatation chart, demonstrated the volume changes which occur with temperature change and at phase transformations and, by the use of T-T-T curves, showed the multiple structures that may occur in large masses because of different rates of cooling. He mentioned the transformation retarding and deep hardening effect of alloys and how they may be taken advantage of in martempering to reduce distortion and cracking.

The three objectives of heat treating are hardness, controlled size and freedom from cracks. Mr. Lull stated that toolsteel of a specified type will always harden to two points Rc if heat treated correctly, that cracking can be controlled by proper preheating, the right quenching temperature and the correct quenching practice. Distortion after machining can be lessened by stress relief before machining operations are started, and by preheating in the heat treating cycle, but since distortion depends upon quenching temperature, grain size, rate of quenching, time of tempering and inherent chemistry and physical makeup of the structure, and particularly upon the mass and geometry of the section, distortion cannot be accurately predicted and wise tool and die engineers will not only insist upon stress relieved stock and preheating for heat treatment but will also allow enough stock to remove decarburization and bring the part to the correct size.—**Reported by E. R. Babylon for Golden Gate.**

Named Editor

Betty Bryan, associate editor of *Metals Review* for the past five years, has been named editor, according to an announcement by W. H. Eisenman, secretary of the American Society for Metals. Miss Bryan came to A.S.M. in 1951 as an editorial assistant on the staff of *Metal Progress,* and was appointed to the staff of *Metals Review* in 1952.

She is a graduate of Simmons College (1950), where she majored in editorial techniques. During the War (1943 to 1945) she served with the U. S. Navy Reserve (Waves), and was discharged as Ph.M. 2/c. She was stationed at the U. S. Naval Hospital, St. Albans, L.I., N.Y., and at the Bureau of Supplies and Accounts, Cleveland Dispensary.

Miss Bryan is a member of the Association of Technical Writers and Editors and is currently secretary of the Cleveland Chapter. She is an ardent ski enthusiast and flew to Austria early in February for a two-week vacation in the Alps.

Marjorie R. Hyslop, who has been editor of *Metals Review* since 1947 and managing editor since 1934, will continue as editor of the *A.S.M. Review of Metal Literature* and as managing editor of *Metal Progress.*

Desulphurization of Molten Iron Topic At Birmingham

Speaker: John N. Hornak
U. S. Steel Corp.

John N. Hornak, assistant director, steel processing, Applied Research Laboratory, U.S. Steel Corp., spoke on the "Desulphurization of Molten Iron" in **Birmingham.**

The ever-increasing demand for low sulphur steels, together with the continual increase of sulphur in raw materials and fuels used in openhearth furnaces, creates ceaseless metallurgical problems. Though steel with a maximum sulphur content as high as 0.300% is specified in some cases, a sulphur concentration greater than 0.030% increases the tendency of steel to crack and tear during rolling, thus increasing conditioning costs and scrap losses. Sulphur also makes steel dirty and renders it unfit for applications such as bearings and aircraft parts.

Desulphurizing steel in an openhearth furnace under the oxidizing conditions that prevail is not an economical operation. Therefore, the solution to the problem appears to be to decrease the total sulphur input. Molten blast furnace iron is a major contributor, and much can be gained by controlling its sulphur concentration. Attention must also be given to the following sources of sulphur: fuel, scrap, limestone, etc.

Special burdening of the blast furnace produces the desired results; however, the production rate is reduced and the operating cost is increased. Hence, all recent studies have involved an external treatment of the molten iron; that is, the desulphurizing agent is added during or after casting.

Desulphurization can be accomplished by the precipitation of manganese sulphide under certain conditions when the metal is chilled. For several reasons, this method is not commercially attractive.

Desulphurization can also be accomplished by the reaction between liquid desulphurizers and molten iron. Liquid basic slags are effective desulphurizers; however, the high handling and preparation costs of this operation exceed the cost of burdening the blast furnace to accomplish the same purpose. Although strong alkalies are effective desulphurizing agents, their use has been precluded because they are difficult to handle and are corrosive to refractories and surrounding equipment; workers must be protected from personal contact and from the fumes produced during desulphurization; also, they readily decrease in efficiency and become ineffective as they become contaminated with acid or blast furnace slag.

Many solid reagents have been used for desulphurization of molten iron. Some, such as burnt lime, are relatively cheap, while others, such as calcium carbide, are more expensive. Various practices for desulphurization by the reaction between solid desulphurizers and molten iron have been tried. A fluidized injection technique has been developed for introducing solid desulphurizing reagents at a considerable depth in the molten metal. For fluidized injection, the reagent is mixed with an inert gas in a pneumatic feeder, and the mixture is conveyed to the ladle through a rubber tube. The mixture of desulphurizer and inert gas is injected below the surface of the metal through a graphite injection tube. Vigorous agitation and rapid mixing with iron results. The resulting slag is a viscous or dry slag; consequently, a natural slag-metal separation is obtained as the desulphurized iron is poured from the ladle.

Sulphur can be controlled in a simple and efficient manner by use of this technique. This control can be exercised after the sulphur content of the iron has been determined. Rather uniform results have been obtained by injecting materials that, when added to the stream or bottom of the ladle, produced erratic results. In these studies, the following materials were effectively used; calcium carbonate, burnt lime, calcium cyanamide and calcium carbonate. The injection technique results in a loss in iron temperature, the degree of which depends upon the temperature at which the iron is treated and the amount of desulphurizer injected. The treating time can be controlled by controlling the rate of feed through a single tube or by using multiple injection tubes. The injection technique eliminates the need for a reladling operation to reduce the sulphur content of the iron. Molten iron may be treated either in the ladle at the blast furnace or in the transfer ladle near the mixer of the openhearth. — **Reported by R. Fisher for Birmingham.**

Receives Medal From French Society

Robert F. Mehl (Left) Receives the Le Chatelier Medal (Grande Medaille) of the French Society of Metallurgy From Baron Walckenaer, President of the Society. At right is Mr. Hayes, first secretary of the U. S. Embassy

Robert F. Mehl, head, department of metallurgical engineering, and director, Metals Research Laboratory, Carnegie Institute of Technology, received the highest honor of the French Society of Metallurgy when he was awarded the "Grande Medaille" at the annual meeting of the Society in Paris on Oct. 23, 1956. The presentation was made by Albert M. Portevin, dean of French metallurgists and honorary member A.S.M.

In presenting the medal to Dr. Mehl, Prof. Portevin outlined the recipient's accomplishments in three different fields—scientific research, influence on industry, and his role as a professor and teacher. The dominant theme of Dr. Mehl's career, according to Prof. Portevin, has been his ability to link the results of physicochemical science to industrial metallurgy. It is therefore most appropriate that Dr. Mehl should have been chosen to be the recipient of the medal this year, since it was designed to honor the memory of Henri Le Chatelier, famed pioneering French metallurgist. Le Chatelier also, according to Prof. Portevin, possessed the unique ability to translate scientific findings into industrial progress.

Finally, Dr. Mehl's brilliant reputation as an educator is based on his pioneering work in introducing both the fundamental and practical research viewpoints to his students, which has so enhanced the value of the university's services to industry.

Modern Automobile Steel Described at Jackson

Speaker: O. W. McMullan

Bower Roller Bearing Div.

Members of the **Jackson Chapter** heard O. W. McMullan, chief metallurgist of the Bower Roller Bearing Division, speak on "Modern Automotive Steels" at a recent meeting. He traced their development, discussed their metallurgy and touched on the economic problems facing those who have the responsibility of choosing materials for their company.

Mr. McMullan stressed the multiple choices of treatment available for the same type of material to induce widely different characteristics in the metal even though the composition remains the same. He also dealt with the pitfalls which may be encountered

O. W. McMullan

if the choice of material and heat treatment is not wisely made.

In a mechanism as complex as the automobile almost every type of steel is used. Of the many steels used the most important to the metallurgist are those which can be heat treated. The low carbon steels are not too important in this regard because there is little or no modification in them on heat treatment except when case hardened.

For certain uses where stiffness or lack of deflection is more important than strength, heat treatment may be of no value because it does not change the modulus of elasticity.

Simple normalizing cycles are satisfactory in promoting machinability of low carbon alloy steels and up to medium carbon content in carbon grades. Frequently it is considered cheaper to machine such steels in the as-received condition rather than incur the expense of normalizing. Higher carbon grades require controlled cooling cycles or full annealing for best machining.

Carbon steels in the range of from 0.30 to 0.50% carbon, and up to 1.00% manganese are usually water or solution quenched. Parts of irregular shape or varying sections may require special quenching or fixtures to prevent cracking or distortion. Even the lower alloy content steels above about 0.35% carbon in the sizes used for automotive parts are apt to crack if water quenched. Control of grain size and hardenability by steel mills has been of great aid toward obtaining uniformity of results both in quenching and in the properties of finished parts. Fine-grained steels have better shock resistance. Flame and induction hardening have made possible the use of water quenching for higher carbon contents in both carbon and alloy steels without the troubles from cracking and distortion. By these methods it is possible to get higher hardness and strength at locations of greatest stress or wear.

It is mechanically sound to use a cheaper low alloy or carbon steel with a highly hardened surface zone rather than a deep hardening high alloy steel. Service stresses are usually concentrated at the surface. It may, however, not be economically sound for the small producer who does not have the proper equipment for heat treating the shallow hardening steels.

Many parts, on account of shape, distortion, etc., do not lend themselves to water quenching. Medium and high carbon alloy steels are oil quenched as are most case hardened steels. Oil quenching results in less distortion, greater uniformity and lower internal stresses. Further improvement may be obtained by quenching in hot oil or salt. Tempering for all steels depends on toughness and wear requirements.

Case hardening is usually confined to low carbon steels although there is an increasing tendency toward higher carbon to give the desired core strength. Medium carbon steels treated by nitrogen containing salts or atmospheres are common for such parts as transmission gears. Case hardening has the advantage of producing over-all toughness, wear resistance from the high carbon surface and strength from the fact that residual stresses in the case are compressive.

A wide range of alloy steels is available for various applications. The tendency has been away from high alloy content and certain elements because of cost or availability. Many steels contain more than one alloying element. Each tends to impart its own influence and a greater than additive effect on hardenability.

An interesting question and answer period concluded the technical part of the program.—**Reported by J. A. Richter for Jackson Chapter.**

Compliments

To ROBERT MADDIN, professor of metallurgy at the University of Pennsylvania, on his appointment as director of the School of Metallurgical Engineering. He is a graduate of Purdue University and received his PhD. degree from Yale University. He is a member of the Philadelphia Chapter.

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To TED OPERHALL, NICHOLAS J. GRANT and RICHARD A. FLINN, who received awards from the Investment Casting Institute for their contributions to the welfare and progress of the Institute and to the investment casting industry. Mr. Operhall and Mr. Flinn are members of the Detroit Chapter; Dr. Grant is a member of Boston Chapter.

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To DAVID STIEFBOLD, on being awarded the A.S.M. $400 Scholarship award at Washington State College. He is a sophomore with a grade average of 3.75.

♦ ♦ ♦

To A. H. D'ARCAMBAL, who was honored at a testimonial dinner by Pratt & Whitney on the occasion of his retirement after 37 years of service. Mr. d'Arcambal is a past chairman of the Hartford Chapter.

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To ARCHER W. P. TRENCH, who has been elected chairman of the board and publisher of the American Metal Market, daily newspaper of the metals industry.

♦ ♦ ♦

To HERBERT G. HAUSSIG, who has been appointed to the engineering staff of Johnston and Funk Titanium Corp., Wooster, Ohio. He was born and educated in Germany, and has worked with Koppers Co., Inc., Republic Steel Corp., and Crown Steel Products.

♦ ♦ ♦

To TADEUSZ SENDZIMIR, on his election to the board of directors of Waterbury Farrel Foundry & Machine Co. Mr. Sendzimir devised the processes for galvanizing and cold and hot strip rolling. He is a member of the New Haven Chapter.

♦ ♦ ♦

To ZAY JEFFRIES, on his re-election as chairman of the board of trustees of Battelle Memorial Institute. Dr. Jeffries, retired vice-president of General Electric Co., was director-general of the First World Metallurgical Congress and has been re-appointed director-general for the Second World Metallurgical Congress to be held in Chicago in 1957. Dr. Jeffries is a founder member of the Cleveland Chapter and a past-president A.S.M.

CHAPTER MEETING CALENDAR

Akron	**Mar. 20**	Sanginiti's		History of Metallurgy
Baltimore	**Mar. 18**	Engineers Club	**A. O. Schaefer**	
Birmingham	**Mar. 5**	Gulas Restaurant		
Boston	**Mar. 1**	Faculty Club	**Panel**	Selection of Heat Treating Equipment
British Columbia	**Mar. 14**		**G. M. Young**	New Alloys of Aluminum
Buffalo	**Mar. 14**	Mann's 300 Club	**D. S. Clark**	Yield Phenomenon in Low Carbon Steels
Calumet	**Mar. 12**	Phil Smidt's		Mechanical Properties of Leaded Steel
Canton-Massillon	**Mar. 5**	Mergus Restaurant	**E. S. Rowland**	Trends in Carburizing
Carolinas	**Mar. 21**	Gastonia	**M. Mianulli**	Brass Means Money
Chattanooga	**Mar. 19**	Maypole Restaurant	**J. T. Waber**	Oxidation of Metals
Chicago	**Mar. 11**	Furniture Club	**A. R. Troiano**	High Strength Steels
Chicago-Western	**Mar. 18**	Spinning Wheel	**J. E. Burke**	Ceramics and Cermets
Cincinnati	**Mar. 14**	Engineering Society	**E. S. Rowland**	High-Temperature Bearing Materials
Cleveland	**Mar. 5**	Hotel Hollenden	**E. C. Smith**	Student Affairs Night—Men and Metals
Columbus	**Mar. 6**	Broad St. Church	**T. E. Eagen**	Practical Aspects of Nodular Iron
Dayton	**Mar. 13**	Engineering Club	**R. H. Aborn**	Heat Treatment and New Uses of Low Carbon Steels
Detroit	**Mar. 11**	Elmwood Casino	**Peter Payson**	Ultra High-Strength Alloy Steels
East New York	**Mar. 12**	Panetta's		Geisler Award and Lecture
Golden Gate	**Mar. 11**	Spenger's Grotto	**D. S. Clark**	What Do Dynamic Lab Tests Tell Us?
Indianapolis	**Mar. 18**	Village Inn	**J. Strauss**	Trace Elements in Metals
Kansas City	**Mar. 20**		**D. Kaufmann**	Commercial and Military Status of Titanium
Lehigh Valley	**Mar. 1**	Hotel Traylor	**Walter Crafts**	Deoxidation of Steels
Long Island	**Mar. 23**	Bethpage Country Club	**Social**	Dinner-Dance
Los Angeles	**Mar. 21**	Rodger Young Auditorium	**D. S. Clark**	Propagation of Plastic Strain in Metal
Mahoning Valley	**Mar. 12**	V.F.W.	**W. R. McCrackin**	Treatment and Hardening of Steel
Milwaukee	**Mar. 19**	City Club	**S. W. Poole**	Metallurgical Service Failures
Montreal	**Mar. 4**	Queen's Hotel	**M. J. Lavigne**	Metallurgical Problems in Development of Atomic Power
Muncie	**Mar. 12**	Ball State Student Center	**D. L. Colwell**	Aluminum and Zinc in the Die Casting Process
New Jersey	**Mar. 18**	Essex House	**A. Bornemann**	Failure Analysis of Metals
New Orleans	**Feb. 28**	Lenfant's	**W. J. Harris**	Selection of Metals in Shipbuilding
New York	**Mar. 11**		**J. G. Althouse**	Bonding and Cladding of Metals
NE Pennsylvania	**Mar. 14**	Irem Temple Country Club	**W. S. Pellini**	Metallurgical and Welding Aspects of Brittle Fracture of Welded Structures
NW Pennsylvania	**Mar. 28**	Meadville	**E. Crankshaw**	Bearings
Notre Dame	**Mar. 13**		**F. W. Boulger**	Metallurgy and Machinability
Oak Ridge	**Mar. 20**	K. of C. Hall	**L. S. Darken**	Applications of Thermodynamics in Metallurgy
Ontario	**Mar. 1**	King Edward Hotel	**Social**	Ladies Night
Oregon	**Mar. 21**	Congress Hotel	**G. M. Young**	New Alloys of Aluminum
Peoria	**Mar. 11**	American Legion	**D. K. Hanink**	Gas Turbine Metallurgy
Philadelphia	**Mar. 29**	Engineers Club	**J. J. B. Rutherford**	Heat Treatment
Philadelphia Jr.'s	**Mar. 11**	Leeds & Northrup	**Plant Visit**	Instrumentation
Phoenix	**Mar. 22**		**G. A. Fisher, Jr.**	National Officers Night
Pittsburgh	**Mar. 14**	Gateway Plaza	**Panel**	Young Fellows Night—Rapid Heating of Metals
Puget Sound	**Mar. 20**	Engineers Club	**G. M. Young**	New Alloys of Aluminum
Purdue	**Mar. 19**	Memorial Union	**H. W. Lownie**	Cast Irons
Rhode Island	**Four Wednesdays in March**		**Educational Program**	Properties of Metals
Rochester	**Mar. 11**	Chamber of Commerce	**C. H. Lorig**	Brittle Behavior of Ferritic Steels
Rockford	**Mar. 27**	Faust Hotel	**C. A. Turner**	Rapid Heating With Gas
Rocky Mt.	**Mar. 15**	Oxford Hotel	**F. L. LaQue**	Operations Sea Horse
St. Louis	**Mar. 15**	Hotel Congress		National Officers Night
San Fernando Valley	**Mar. 19**			Charter Night Meeting
Savannah River	**Mar. 7**	Tinnerman's Lodge	**Social**	Blacksmith's Ball
Southern Tier	**Mar. 11**	Corning Glass Works	**A. M. Aksoy**	Vacuum Melting and Vacuum Heat Treatment
Springfield	**Mar. 19**	Blake's Restaurant	**A. M. Miller**	Aluminum
Texas	**Mar. 5**	Ben Milam Hotel	**J. H. Moore**	Vacuum Metallurgy
Toledo	**Mar. 14**	Maumee Yacht Club	**R. J. Gray**	Practical Metallurgy
Tulsa	**Mar. 5**	Alvin Hotel	**E. N. Skinner**	Selection of Alloys for High-Temperature Service
Utah	**Mar. 20**		**G. A. Fisher, Jr.**	Alloy Steels and Their Heat Treatment
Vancouver	**Mar. 19**	Pacific Club	**G. M. Young**	New Alloys of Aluminum
Washington	**Mar. 11**		**M. E. Carruthers**	Precipitation Hardening Stainless Steels
West Michigan	**Mar. 18**	Morton House	**Panel**	Heat Treating Procedures and Equipment
Western Ontario	**Mar. 1**	Cobblestone Inn	**Social**	Ladies Night
Wilmington	**Mar. 12**	DuPont Country Club	**R. B. Mears**	Electrochemistry of Passivity and Inhibition
Worcester	**Mar. 13**	Hickory House	**Dwayne Orton**	Tomorrow's Managers
York	**Mar. 13**	Lancaster	**C. A. Zapffe**	Fractography

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared at the Center for Documentation and Communication Research, Western Reserve University, Cleveland, With the Cooperation of the John Crerar Library, Chicago.

Annotations carrying the designation (CMA) following the reference are published also in *Crerar Metals Abstracts*.

A General Metallurgy

26-A. Report on Russia, Part 3 . . Research and Training. *American Machinist,* v. 100, Dec. 17, 1956, p. 116-119.

Description of ENIMS, the Russian tool research organization; photographs of new machine tools developed. (A9h, W25)

27-A. Main Metal: A New Aluminum Zinc Alloy Suitable for Extrusion and Sand and Die Casting. *Automobile Engineer,* v. 46, Dec. 1956, p. 534-535.

New light, easy to machine alloy with good bearing properties. Machining techniques suggested. (A general, G17; Zn, 4-8, 5-10, 5-11)

28-A. San Antonio Chemicals Starts With Waste Liquor From Lithium Processing . . . Recovers Mixed Carbonates Rich in Scarce Rubidium, Cesium. *Chemical Week,* v. 79, Dec. 29, 1956, p. 78-80.

70% K_2CO_3, 23% Rb_2CO_3, 3% Na_2CO_3, 2% Cs_2CO_3, 1% Li_2CO_3 from lithium end liquors. (A11c; Li, Rb, Cs)

29-A. New Magnesium Alloy for Sounder Castings. W. E. Pearson and T. E. Leontis. *Iron Age,* v. 178, Dec. 13, 1956, p. 127-129.

Magnesium alloy designated AZ 81A is 7.6% aluminum, 0.7% zinc; alloy has low microporosity, good castability, responds to heat treatment and has desirable mechanical properties. (A general; Mg, 5)

30-A. Let Conditioners Clean up Your Air Problems. W. G. Patton, *Iron Age,* v. 178, Dec. 13, 1956, p. 136-137.

Plant-wide air conditioning protects product quality and workers' comfort for battery manufacturer. (A5, W1)

31-A. Nickel Silvers. John L. Everhart. *Materials and Methods,* v. 44, no. 6, Dec. 1956, p. 117-132.

Copper-nickel-zinc alloys characterized by white color and corrosion resistance. Data on commercial grades, engineering properties, forming, machining, heat treating, joining, cleaning, finishing and applications. (A general; Cu)

32-A. A Dictionary of Metallurgy. A. D. Merriman and . S. Bowden. *Metal Treatment And Drop Forging,* v. 23, Dec. 1956, p. 487-494.

From "ultrabasite" to "vialbra". (To be continued.) (A general, 11-17)

33-A. How to Collect and Dispose of Magnesium Dust and Chips. T. Kenneth McGuire. *Modern Metals,* v. 12, no. 11, Dec. 1956, p. 38-41.

Ducts and hoods designed to prevent the accumulation of dust used in combination with wet collection equipment allow safe handling and disposal. (A8a, A8d; Mg)

34-A. Aluminum's Future. Bert Inch. *Modern Metals,* v. 12, Dec. 1956, p. 62-65.

Predicts that consumption will double by 1965 with automobiles, boats and furniture being the largest users. (A4p, T21, T22, T10; Al)

35-A. End-Use Statistics Show Where the Aluminum Goes. *Modern Metals,* v. 12, Dec. 1956, p. 74.

End use of wrought products, permanent mold castings and sand castings. (A4p; Al)

36-A. New World of Manufacturing. Del S. Harder. *Steel Processing,* v. 42, Dec. 1956, p. 683-685, 714.

Predictions of developments in mining, materials and manufacturing. (A general, B12; 17)

37-A. Super-High Strength Constructional Steels. H. P. Tardif. *Steel Processing,* v. 42, Dec. 1956, p. 702-704, 709-710.

Review of composition and optimum physical properties of typical ultra high-strength steels such as modified medium carbon triple alloy steels; possible new procedures; heat treating, hardening and machining. 25 ref. (A general; AY, SGB-s)

38-A. Zircaloy Alloys. D. E. Thomas. Paper from "Zirconium-Technology and Economics". Atomic Industrial Forum, p. 47-50. (CMA)

The subject coding at the end of the annotations refers to the revised edition of the ASM-SLA Metallurgical Literature Classification. The revision is currently being completed by the A.S.M. Committee on Literature Classification, and will be published in full in late spring or early summer. A schedule of the principal headings in the revised version is published on p. 6, this issue.

The Zircaloys may be described as tin and iron alloys of zirconium. Crystal bar zirconium and Zr-Sn alloys did not come up to expectations. In Zircaloy-2, the 1.5% Sn is in solid solution and the iron, nickel and chromium are present as precipitated intermetallic phases. The transverse and longitudinal tensile strengths are about equal. Cold working to 60% is practical; strength is then increased. Crystallography and heat treatments discussed. (A general; Zr)

39-A. Over-All Supply of Refined Zirconium Metal. N. C. Bartholemew. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 59-64. (CMA)

Prospective users of zirconium are urged to choose their data carefully and use only those assigned to the particular process used. Present market, current research and development reviewed, considerations in forcasting zirconium demand enumerated. (A11a, A4p, Aq; Zr)

40-A. Commercial Products Available. W. C. Greenleaf. Paper from "Zirconium — Technology and Economics". Atomic Industrial Forum, p. 65-68. (CMA)

Prices for conversion of zirconium or Zircaloy ingots to verious sizes of fabricated forms are tabulated. The costs of melting sponge to ingot given. (A4q; Zr)

41-A. (French.) Zirconium. René Faivre. *Chimie et Industrie (Supplément: Energie Nucléaire),* v. 76, Oct. 1956, p. 32-45. (CMA)

Physical, chemical and mechanical properties of zirconium briefly outlined, including effective cross section (unusually low) for the absorption of thermal neutrons. Zirconium ores and their principal deposits are enumerated, and the principal metallurgical processes for preparing metal zirconium are explained. 35 ref. (A general; Zr)

42-A. (Japanese.) Permanent Magnet Selection and Application. Kuzuo Yamakawa. *Metals,* v. 26, Dec. 1956, p. 938-944.

Kinds of magnetic materials; application and function of permanent magnets (magnets for electrical measurement, radio, television, Brown tubes, generators, speed meters, electric motors). A new permanent magnet described. (A general; SGA-n)

43-A. (Japanese.) Developing of Permanent Magnet. *Metals,* v. 26, Dec. 1956, p. 945-949.

Permanent magnets developed, produced and applied in Japanese industry. (A general; SGA-n)

44-A. (Japanese.) **Sintered Aluminum Powder as Atomic Furnace Material.** *Metals,* v. 26, Dec. 1956, p. 953-959.

Method for production of SAP (sintered aluminum powder); physical and mechanical properties of SAP; mechanical properties at high temperature, mechanical working and corrosion of SAP. 24 ref.
(A general; Al, 6-22)

45-A. (Japanese.) **Silicon Zinc Bronze.** Tamotsu Nakai. *Metals,* v. 26, Dec. 1956, p. 969-970.

List of silicon zinc bronzes. Phase diagram, chemical composition, production methods, workability; physical, chemical and mechanical properties. (A general, Cu)

46-A. (Japanese.) **Phosphor Bronze.** Takeo Tada. *Metals,* v. 26, Dec. 1956, p. 971-972.

Chemical, physical and mechanical characteristics; heat treatments and application of phosphor bronze.
(A general, Cu)

47-A. (Japanese.) **Special Phosphor Bronze.** Myokazu Kamitani. *Metals,* v. 26, Dec. 1956, p. 973-974.

Chemical composition, production method, workability and heat treatment of special phosphor bronze.
(A general; Cu)

48-A. Phenomenal Growth of the Titanium Industry. W. Schweisheimer. *Australasian Engineer,* v. 49, Nov. 7, 1956, p. 65-66. (CMA)

The status of the titanium processing industry in the United States is described; new plants and expansions of existing facilities are frequent developments. Ore sources are found scattered throughout the world but are chiefly in the form of beach sands containing rutile. The Oaxaca rutile deposits are noted. An example of titanium application is the Hi-Ti bolts of Standard Pressed Steel Co.
(A4p, A11a, T general; Ti)

49-A. Steel Making Since Bessemer. Charles Goodeve. *Machinery Lloyd (Overseas Edition),* v. 28, Dec. 8, 1956, p. 70-77.

Comments on the inventions of Henry Bessemer, and some later developments in steelmaking.
(A2, D general; ST)

50-A. New Occurrences of Vanadium Minerals (Mottramite, Descloizite, and Vanadinite) in the Caldeck Area of Cumberland. A. W. G. Kingsbury and J. Hartley. *Mineralogical Magazine,* v. 31, Dec. 1956, p. 289-295. (CMA)

Four new occurrences of vanadiferous minerals in the British Isles described. Powder photographs are shown for descloizite, mottramite and vanadinite. X-ray data are tabulated. (A11a; V)

51-A. Opportunities for Minerals Research. J. H. East, Jr. *Mines Magazine,* v. 46, Nov. 1956, p. 63-66.

Extensive research required for full development of Missouri Basin mineral reserves. 13 ref.
(A11a; RM-n)

52-A. U. S. Program and Policies in the Uranium Field. Jesse C. Johnson. *South African Mining and Engineering Journal,* v. 67, Part 2, no. 3329, Nov. 30, 1956, p. 907-911.

American and world production of uranium; current power reactor economics. (A4p, W11; U)

53-A. Metalworking Facts and Figures. *Steel,* v. 140, Jan. 7, 1957, p. 167-214.

Data on production, shipments, consumption and prices of irons, steels, aluminum, copper, lead, zinc, magnesium, titanium, nickel, tin and antimony. Units produced for transportation, industrial equipment, containers, refrigeration, home appliances and farm machinery. Sales, price and labor information.
(A4p, T3, T10, W general)

54-A. Nonferrous Metal Production Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 224-254.

Important factors in the past and coming year in production as briefly stated by 18 of the industry's leaders. A few of the points are: short supply of nickel; increased production of titanium and aluminum; technological improvements increase use of titanium and magnesium.
(A4p, T general; Ni, Ti, Al, Mg)

55-A. Materials and Metallurgy Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 266-290.

Twenty-nine of the industry's executives state important developments and possible future trends. A few of the features are: rapid development of vacuum melting; 200-series stainless steel alloys find increasing use; advances made in materials for aircraft applications capable of withstanding high temperatures. (A general)

56-A. Bright Supply Outlook for Aluminum Clears Way for Rapid Development of New Uses and Markets. I. W. Wilson. *Waste Trade Journal,* v. 106, Jan. 5, 1957, p. 35-42.

Three million tons will be available by 1958; usage may be five million tons by 1957. (A4p; Al)

57-A. In Diversified Manufacturing Operations Production Control Is the Key. A. R. Weigel. *Western Machinery and Steel World,* v. 47, Dec. 1956, p. 70-72.

Procedure followed in job scheduling. (A5b)

58-A. Zirconium and Zirconium Alloy Products. M. F. Judkins. Paper from "Zirconium—Technology and Economics", Atomic Industrial Forum, p. 85-87. (CMA)

Zirconium has been available in small amounts for some time as iodide crystal bar, and Kroll sponge is now available in tonnage lots. Tubing may be fabricated by roll forming, welding of strip and swaging, by piercing and drawing and by extrusion. Size ranges are given for ingots, billets, slabs, bar, strip, sheet and wire. High cost of the metal discussed.
(A general, A11a, F general; Zr)

59-A. (English.) **Notes on the Geochemistry of Germanium.** Hiroshi Onishi. *Chemical Society of Japan, Bulletin,* v. 29, Aug. 1956, p. 686-694.

Occurrence of germanium; analyses of germanium-bearing rocks.
(A11a, S11; Ge)

60-A. (French.) **Metallurgy of Uranium.** G. Cabane. *Energie Nucleaire,* v. 76, no. 4, Oct. 1956 supplement, p. 18-24.

Developments in the metallurgy of uranium during the past 10 years. 52 ref. (A general; U)

61-A. (Report.) **Development of a Forgeable High-Strength, High-Temperature, Chromium-Rich, Chromium-Iron Alloy, Part 2.** D. P. Moon, H. A. Blank and A. M. Hall, Battelle Memorial Institute for Wright Air Development Center. 26 p., Oct. 1954. U. S. Office of Technical Services PB 121112. $.75.

Report concerns production of experimental alloys composed of 70 Cr, 30 Fe, 9 Mb, 2 to 3 Ti and up to ½ Al by induction melting charges of commercially available melting stock, casting into molds, and fabricating by various hot working methods. Forged bars exhibited remarkable thermal-shock properties up to 2000° F.
(A general, D6, F general, Q23s, 2-12; Cr, SGA-h)

62-A. (Pamphlet—Russian.) **High-Strength Aluminum Alloy V95.** I. N. Fridlyander and Ye. I. Kutaytseva. 62 p. 1956. *Informataiva o Nanchno-Issledoyatel' Skikh Rabotakh* No. I-56-34, Moscow.

Extensive review of the Soviet aluminum alloy V-95. Mechanical properties of the aluminum-magnesium-zinc-copper system, the solution treatment, precipitation hardening, and corrosion resistance of aluminum-magnesium-zinc and aluminum-magnesium-zinc-copper system alloys and the effect of manganese and chromium and iron and silicon on the V-95 alloy. (A general; Al)

63-A. (Book.) **Chromium-Nickel Austenitic Steels.** F. H. Keating. 138 p. 1956. Butterworths Scientific Publications, 88 Kingsway, London, W.C.2. $3.50.

A reference book for the practical man, covering the development and metallurgy of these steels, manufacturing and fabricating processes, castings, mechanical and physical properties, corrosion resistance, and chemical analysis. (A general; SS)

64-A. (Book.) **Encyclopaedia of the Iron and Steel Industry.** A. K. Osborne. 558 p. 1956. Technical Press Ltd., North Circular Rd., Neasden, London, N. W. 10, England: also Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. $25.00.

Expansion of the "Glossary" previously compiled by the author. Includes "New Processes" section and bibliography.
(A general; Fe, ST; 11-17)

65-A. (Book.) **Materials and Processes in Manufacturing.** E. Paul DeGarmo. 755 p. 1957. MacMillan Co., 60 Fifth Ave., New York 11, N. Y. $8.50.

College text for engineering students. Introduction to materials, machine tools and manufacturing methods with emphasis upon choice, handling and behavior of materials. Considerable use of visual illustrations. Selected bibliography.
(A general, 1; 17-7)

66-A. (Book.) **Reaumur's Memoirs on Steel and Iron.** Anneliese Grunhaldt Sisco. 395 p. 1956. University of Chicago Press, 5750 Ellis Ave., Chicago 37, Ill. $6.00.

Reproduction of the first significant book ever devoted to the iron and steel industry. (A2; Fe, ST)

67-A. (Book.) **Statistical Tables on Aluminum, Lead, Copper, Zinc, Tin, Cadmium, Magnesium, Nickel, Mercury and Silver.** 219 p. 1956. Statistics compiled by Metallgesellschaft AG., Reuterweg 14, Frankfurt Am Main, Germany.

Surveys production, consumption and prices, 1946-1955.
(A4p, A4q; Al, Pb, Cu, Zn, Sn, Cd, Mg, Ni, Hg, Ag)

68-A. (Book.) **Zirconium—Technology and Economics.** Industrial Committee on Reactor Materials Subcommittee on Process Metallurgy and Fabrication. 113 p. 1956. Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16, N. Y. (CMA)

The proceedings of a meeting on

zirconium technology and economics held in New York on Nov. 17-18, 1955. Topics covered include production of metallic zirconium, fabrication, properties, supply, commercial products available, future requirements. Papers are abstracted separately. (A general; Zr)

69-A. (Book.) **English-German and German-English Dictionary for the Iron and Steel Industry.** Edward L. Kohler. 330 p. 1955. Springer Verlag, Vienna, Austria.

Vocabulary taken from current technical literature for use of iron and steel engineers and translators. (A general, 11-17; Fe, ST)

B Ore and Raw Material Preparation

8-B. From Pit to Pellet. Reserve Mining Co., Taconite Project. *Engineering and Mining Journal,* v. 157, Dec. 1956, p. 78-79.

Flow sheet and step-by-step explanation. (B16b; Fe, 14-9)

9-B. Sintering Characteristics of a Cleveland Ironstone. P. K. Gledhill and C. Lang. *Iron and Steel Institute, Journal,* v. 184, Dec. 1956, p. 434-437.

Output of blast furnace sinter; degree of oxidation and percentage of sulphur removal. (B16a; Fe)

10-B. Over-All Zirconium Supply (Raw Materials). H. A. Sharpe. Paper from "Zirconium — Technology and Economics". Atomic Industrial Forum, p. 55-58. (CMA)

The mineral sources, occurrences and ore-recoveryy of zirconium reviewed. Operations of Humphries Gold Co. and Florida Ore Processing Co. on beach sand deposits and the equipment they use described. (B general, A11a; Zr)

11-B. (English.) **Fluidized-Bed Roasting of Pyrite.** Motoo Watanabe and Akiichi Kigoshi. *Science Reports of the Research Institutes, Tohoku University,* v. 8, Dec. 1956, p. 511-531.

Material, preliminary considerations of chemical reactions, apparatus and procedure; results given as tables. Discussions of results from the point of unit operations. (B13g; Fe, Cu, Co, 14-9)

C Extraction and Refining

15-C. Arc and Vacuum Melting of Titanium. D. E. Cooper and S. A. Herres. *Metal Industry,* v. 89, Dec. 7, 1956, p. 471-474. (CMA)

The development of melting techniques for titanium reviewed. Furnace equipment used in early melting studies described; advantages of the inert electrode type furnace noted. The consumable electrode furnace operates differently from the inert electrode furnace in that the electrode material is driven toward the arc; normally, there is a feedback control for measuring arc voltage or current and a partial vacuum is preferred for arc stability and degassing. Research by the Bureau of Mines on pool size and shape is cited; it would be desirable to increase the superheat and volume of the molten pools, but reversing the polarity of the electrodes does not accomplish this. (C5h; Ti)

16-C. Chemistry and Reduction of Zirconium. W. W. Stephens. Paper from "Zirconium — Technology and Economics". Atomic Industrial Forum, p. 5-10. (CMA)

The chemical reactivity and amphoteric character of zirconium are cited. Facts concerning the abundance of zirconium ores and the occurrence of hafnium in them are reviewed. Methods are discussed for the production of zirconium: thermal decomposition of the iodide process refines zirconium which is already reduced to the metal and the Kroll reduction is the main route used in extractive metallurgy. A subsequent discussion of the paper encompasses sampling for quality control and the difficulty of keeping the oxygen content low. (C general, A11a; Zr)

17-C. Melting of Zirconium. W. C. Greenleaf. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 11-17. (CMA)

Of the four melting techniques noted, the consumable arc-melting technique with water-cooled copper crucible has met with the most success. The Allegheny-Ludlum procedure for melting 1000-lb. Zircaloy-2 ingots includes sponge compacting, welding the compact according to a proprietary pattern, inserting the compacted electrode into the furnace, evacuating the chamber, flooding with argon, re-evacuating and then re-introducing argon. After the current is supplied, melting is allowed to go to completion. After the ingot cools, secondary melting may be performed; more current is necessary because of increased density. Discussion included. (C5h; Zr)

18-C. Commercial Products Available. E. E. Hayes. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 73. (CMA)

The Bureau of Ships and the AEC have sponsored arc-melting projects on zirconium by the Bureau of Mines. Present practice at the Albany station is to melt the metal into a water-cooled copper crucible (1-in. diam. by 1-in. deep), using a high input and keeping the pool deep. The melt is then quickly poured from the crucible, leaving a slight skull, into a suitable mold. Graphite molds give sound castings. (C5h; Zr)

19-C. Vacuum Arc Melting Zirconium. L. S. Deitz, Jr. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 79-84. (CMA)

Climax Molybdenum studied the vacuum arc melting of zirconium in 1952-1953. The experimental arc-melting furnace used is described; the process is a batch-type. The Kroll-type sponge melted in the a.c. arc with much splatter, causing porosity on the outside of the ingot. It is difficult to raise the bath temperature without increasing the melting rate, and the removal of the porous deposit on the mold wall was precluded. The problem of tin segregation in Zr-Sn alloys was not solved. Data tabulated. (C5h; Zr)

20-C. Commercial Products of Zirconium Available From National Research Corporation. F. H. Greene, Jr. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 91. (CMA)

The activities of the National Research Corp. with zirconium are reviewed. Metal and alloy ingots weighing 25 lb. and zirconium shaped castings to specifications are produced. Melting and heat treating equipment for zirconium and titanium are being designed and manufactured. (C5, J general; Zr)

21-C. (English.) **Study of Chlorination Reactions of Titanium Monoxide.** A. N. Zelikman and T. Segarchanu. *Journal of General Chemistry of the U.S.S.R.,* v. 26, no. 3, March 1956, p. 721-724. (CMA)

The chlorination of TiO was studied in 300 to 700° C. range. TiO chlorinates faster than TiO_2, even at 300° C., and the presence of carbon accelerates this trend. The maximum degree of chlorination is 50%. The reaction proceeds as $2TiO + 2Cl_2 \rightleftharpoons TiCl_4 + TiO_2$. Data are tabulated and illustrative material is shown. 6 ref. (C19r; Ti)

22-C. (French.) **Defect Elimination in Leaded Bronze.** *Journal d'Informations Techniques des Industries de la Fonderie,* no. 81, Oct. 1956, p. 3-5.

The defect is characterized by numerous irregular slag inclusions which on machining produce a grayish powder. Composition of slag and procedure for elimination are given. (C21; Cu, 9-19, RM-q)

23-C. (Russian.) **Separation of Zirconium and Hafnium.** L. N. Komissarova and V. E. Plyushchev. *Uspekhi Khimii,* v. 25, Oct. 1956, p. 1197-1222. (CMA)

The literature on the separation of zirconium and hafnium is surveyed. Twenty-seven methods are examined, classified under the following groups: (1) fractional crystallization; (2) fractional precipitation; (3), thermal decomposition; (4) sublimation and distillation of zirconium and hafnium halogenides, or of their molecular compounds (e.g. with phosphorus pentachloride); (5) adsorption and ion exchange; and (6) extraction of zirconium and hafnium compounds with organic solvents. 123 ref. (C general; Zr, Hf)

24-C. Production of Titanium Metal. Raw Materials and Methods Reviewed. *Chemical Age,* v. 76, Dec. 22, 1956, p. 475-476. (CMA)

Chemical analyses of rutile and ilmenites from Florida and Canada are compared. Rutile is more desirable because it is more readily chlorinated. The direct chlorination of ilmenite produces $FeCl_3$, which is very convenient, and the chlorination of titania slags also has drawbacks. A process has been described which involves carbon reduction of ilmenite and magnetic separation of iron from the resulting titanium oxycarbide. An Acheson-type furnace is used. Details as to charge, furnace cooling and crushing are given. (C1p; Ti, 14-9)

25-C. ICI's Huge Titanium Project Benefits Fabricating Industries. *Chemical Industry and Engineering,* v. 8, Nov. 1956, p. 43-47. (CMA)

History of ICI's interest in titanium. After some research a sodium reduction process was chosen because of cost advantages, especially in leaching out and disposing of the chloride byproduct. The granular titanium is packed in drums and shipped to Witton to be wrought and fabricated. Titanium is used in models of advanced British aircraft. (C19r; Ti)

26-C. Arc and Vacuum Melting of Titanium. D. E. Cooper and S. A. Herres. *Metal Industry,* v. 89, Dec. 14, 1956, p. 499-500. (CMA)

In arc melting titanium, the solenoid-type magnetic field which controls arc motion also stirs the molten pool. Increasing the stirring rate decreases surface porosity to a minimum point and then increases it. Effects on chemical homogeneity also studied. The stirring breaks up large columnar grains which usually are evident when the ingot solidifies, but stirring must be rapid if high melting currents are used.
(C5h; Ti)

27-C. The Inventions of Bessemer in Relation to Nonferrous Metals. Hugh O'Neill. *Metallurgia,* v. 54, Dec. 1956, p. 269-273.

Account to the South Wales Local Section of the Institute of Metals referring to Bessemer's inventions in nonferrous metallurgy and procedures involving pneumatic oxidation. 15 ref. (C21)

28-C. South African Uranium Leach Plants. L. A. Waspe. *Mining Magazine,* v. 95, Dec. 1956, p. 332-339.

South African practice in obtaining uranite and monazite from gold ore residues. (C19n; Au, U)

29-C. (French.) **Thorium and the Fissionable Elements.** *Energie Nucleaire,* v. 76, no. 4, Winter 1956, p. 25-31.

Properties of uranium^{235}, uranium^{233} and plutonium; separation of uranium^{235} from irradiated thorium.
(C6, P general, Q general; Th, U, Pu)

30-C. (French.) **French Manufacture of Aluminum.** Gaston Dufour. *L' Ingenieur,* v. 42, no. 168, Winter 1956, p. 7-11.

Handling of bauxite, production and processing of alumina, preparation of ingots. (C23, F21; Al)

31-C. (Russian.) **Methods for the Isolation of Carrier-Free Radioactive Isotopes. Communication 3. Isolation of the Radioactive Indium Isotope In^{113m}.** N. P. Rudenke and Z. V. Pastukhova. *Zhurnal Neorganichaskoy Khimii,* v. 1, Sept. 1956, p. 2164-2170.

Method for the isolation of In^{113m} from tin irradiated with neutrons whereby the recoil atoms of the radioactive indium are concentrated in a high-intensity electric field. Deposition of radioactive indium at the electrode proceeds best when a field of the intensity of 3000-4000 volts per centimeter is applied for 30-150 min. (C6a; In, Sn)

D Iron and Steelmaking

39-D. Development of Continuous Casting at Atlas Steels, Ltd. William W. Jacobs. *Iron and Steel Engineer,* v. 33, no. 12, Dec. 1956, p. 92-97.

A number of automatic controls developed, size of mold changed, information on solidification developed, and a method of adding aluminum to the mold. (D9q, D9r; ST)

40-D. Sound Steel Without Hot Tops at Green River Steel Corp. George A. Dornin, Jr. *Iron and Steel Engineer,* v. 33, No. 12, Dec. 1956, p. 125-133.

By the use of a process which starts with a short and squatty ingot in casting operation, pipe and segregation are minimized. The quality, design and forging process in connection with squatty ingots.
(D9k, F22, ST, 9-17, 9-19)

41-D. Influence of Manganese on the Desulphurization of Pig-Iron. R. A. Hacking and E. A. Shanahan. *Iron and Coal Trades Review,* v. 158, Dec. 14, 1956, p. 1427-1432.

Sulphur is a serious problem because of the necessity for using lower grade ores; manganese sulphide flotation is helpful in some instances. 14 ref.
(D11, CI-a, *Mn,* AD-a)

42-D. Attack on Open-Hearth Refractories by Iron Oxide: Effect of Contaminants. A. W. Archibald. *Iron and Coal Trades Review,* v. 158, Dec. 14, 1956, p. 1443-1446.

Mechanism of the attack of iron oxide on silica bricks. Wear is caused primarily by slag droplets (iron oxide) dissolving silica.
(D2; RM-h)

43-D. Oxygen in Iron and Steel Production. D. J. O. Brandt. *Iron and Coal Trades Review,* v. 158, Dec. 14, 1956, p. 1451-1452.

Oxygen can be added to inferior gaseous fuels to enrich the flame of openhearth furnaces. Bessemer converters using oxygen are able to make high-quality steel.
(D10, D2g; ST)

44-D. Automatic Stock-Level Control on Blast-Furnaces. I. Kjellman and K. Gronblad. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 588-589.

A mechanical intermittent system with cam-operated contact gear for movement-translating. (D1b, 18-24)

45-D. Measurement of Gas Transit Time in a Blast Furnace. T. W. Johnson. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 590-592.

Sampling system using radioactive tracers is described.
(D1b, S11q, S11r)

46-D. Studies of Blast Furnace Assessment. J. M. Ridgion and A. M. Whitehouse. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 592-595.

Statistical study of the routine operating data having influence on fuel consumption and productivity.
(D1b, S12)

47-D. Total Heat of Commercial Steels. J. R. Pattison. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 599-600.

Total heat of seven carbon steels between 0° and 650° C. Data for silicon steels, alloy steels.
(D11; AY, *Si*)

48-D. Design of Ingots. Principles for High Output in the Slabbing Mill. H. G. Jones, P. D. Dickerson and D. T. Steer. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 612-613.

Effect of ingot width, thickness and height. (D9, 5-9, 17-1; ST)

49-D. Steelmaking, and Forum of Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 218-242.

Thirty-three of the industry's leaders contribute brief notes to outline recent developments and the direction of future progress. Among the many developments mentioned are continuous casting for carbon steel, more use of rare earths and increased number of oxygen converters.
(D general; ST)

E Foundry

29-E. Modernized Foundry Can Turn Out 75,000 Aluminum Pistons Per Day. George E. Toles. *Automotive Industries,* v. 115, Dec. 15, 1956, p. 56-59.

New Chrysler aluminum piston foundry at Highland Park has increased capacity about 50%. Automatic casting machines, power shears and conveyors are used.
(E general, 18-24; Al)

30-E. New Developments Studied at Fourth Annual Meeting of ICI. *Automotive Industries,* v. 115, Dec. 15, 1956, p. 61, 161.

Glascast shell process; investment "X" process. (E16c, E15)

31-E. Green Sand Molding of Large Steel Casting. Charles W. Briggs. *Foundry,* v. 85, No. 1, Jan. 1957, p. 86-93.

Practices of 31 American and 2 Canadian foundries; types of sand, reclaiming sand, bonding materials, mulling conditions. (E19a; ST)

32-E. New Mechanized Nonferrous Foundry Stresses High Quality. Robert H. Herrmann. *Foundry,* v. 85, no. 1, Jan. 1957, p. 94-99.

Mechanized molding and sand handling in jobbing foundry producing aluminum and bronze castings.
(E19, 18-24; Al, Cu)

33-E. Brass Foundry Molding Practice. Harry St. John. *Foundry,* v. 85, no. 1, Jan. 1957, p. 100-103.

Green sand and dry sand molding practices. (E19; Cu)

34-E. Things to Watch in Producing Sound Investment Castings. C. W. Schwartz. *Foundry,* v. 85, no. 1, Jan. 1957, p. 110-115.

Causes and suggested remedies of defects found by visual inspection.
(E15, 9)

35-E. Mechanization in Small Foundries. Chester V. Nass. *Foundry,* v. 85, no. 1, Jan. 1957, p. 137-142.

Factors determining extent of mechanization. (E general, 18-24)

36-E. Light Alloy Casting by Frozen Mercury Process. Edward J. Vargo. *Light Metal Age,* v. 14, Dec. 1956, p. 10-11, 38.

Advantages of frozen mercury process are dimensional stability, good surface finish, ability to produce complex castings.
(E15; EG-a39, Hg)

37-E. Antifreeze Techniques for CO_2 Process. Roy McIlrath. *Modern Castings,* v. 31, Jan. 1957, p. 36-37.

Techniques for avoiding formation of "CO_2 Snow" when introducing carbon dioxide into cores or molds.
(E19, E21; RM-g)

38-E. New Idea—Warm Blast Cupolas. Wm. Y. Buchanan. *Modern Castings,* v. 31, Jan. 1957, p. 40.

Recuperative hot blast with modest cost heating chamber proves successful in melting cast iron borings. (E10a, W19; CI)

39-E. Casting With Glass. *Modern Metals,* v. 12, Dec. 1956, p. 78-80.

Procedure for making disposable glass molds by coating wax pattern with "Glascast". Completed mold will stand metal pouring temperature as high as 3300° F.
(E15, W19; RM-j42)

40-E. (French.) **Deformations and Cracks.** Joseph Leonard. *Fonderie,* no. 129, Oct. 1956, p. 389-394.

Deformation is an action of the whole casting causing strains and sometimes cracks and fissures; cracks and fissures can be independent of the deformation and be affected by local phenomena; a number of forces affect each part; the last may be the determinant in exceeding tolerances. (E25, 9-22)

41-E. Mechanized Foundry at Horwich, London Midland Region. *Railway Gazette,* v. 105, Dec. 7, 1956, p. 669-671.

Modern foundry for the manufac-

ture of chairs, baseplates and brakeblocks. (E general, 18-24)

42-E. Centrifugal Casting Moves Ahead. Nathan Janco. *Steel,* v. 139, Dec. 24, 1956, p. 72-73.

Advantages and problems of permanent mold usage; water-cooled steel molds increasingly popular. (E14, W19)

43-E. (Japanese.) **Progress in Cast Iron and Cast Steel Techniques.** Nobutaro Kayama. *Nippon Kikai Gakai,* v. 59, no. 454, Nov. 1956, p. 13-16.

Progress of cupola operations concerning air blast vs. gas analysis, specific gravity of cast material, coke grain size and the temperature of air blast. Improvement of cast iron material. Japanese cast iron standards, fluxing operations. 6 ref. (E10a; CI, 15-9)

44-E. (Book.) **The Diecasting Process.** H. K. Barton. 224 p. 1956. Macmillan Co., 60 Fifth Ave., New York 11, N. Y. $5.00.

Pressure diecasting; dies, machines, machining, finishing, production techniques; glossary of diecasting imperfections; selective bibliography. (E13)

45-E. (Book—Russian.) **Smelting and Casting of Light Alloys.** M. B. Alttman, A. A. Lebedev, A. P. Polyanskiy and M. V. Chukhrov. 491 p. 1956. Metallurgizdat, Moscow, U.S.S.R.

Fundamental technological processes of smelting and casting aluminum and magnesium alloys; information on casting in sand molds, chill molds, pressure casting, shell casting and investment casting; furnace layouts for smelting. Collection and reprocessing of tailings and methods of inspecting castings and the mechanical properties of alloys. 21 ref. (E general, C21; Al, Mg)

F Primary Mechanical Working

20-F. Hand Rolling, Good Scheduling Boosts Mill's Efficiency. W. G. Patton. *Iron Age,* v. 178, Dec. 27, 1956, p. 62-64.

Bar mill producing stainless items minimizes down time due to roll changes by careful scheduling and design. (F27; SS)

21-F. Rolling of Thin Strip, Part II. M. D. Stone. *Iron and Steel Engineer,* v. 33, No. 12, Dec. 1956, p. 55-76.

Pressure multiplication factor and rolling torque are expressed as a function of roll bite friction, flattened roll contact length and strip thickness being rolled. Nomograph for determining rolling pressures and powers. Power requirement per ton is expressed by work roll size, speed of rolling. (F23; 4-3)

22-F. Hot Extrusion of Carbon Steel Solid Sections. Joseph K. Seyler. *Iron and Steel Engineer,* v. 33, no. 12, Dec. 1956, p. 89-91.

Hot extrusion is a specialized tool, particularly suitable for small orders and complicated sections. (F24; CN)

23-F. Cause and Prevention of Hot Strip Work Roll Banding. Charles E. Peterson. *Iron and Steel Engineer,* v. 33, no. 12, Dec. 1956, p. 98-101.

Three practices suggested: remove all scale from strip before entering finishing stands; select a roll material combining high hardness with freedom from graphite; apply large quantities of water at elevated temperatures to keep the rolls cold while rolling. (F23; 4-3)

24-F. Relative Value of Various Gases for Scarfing. W. M. Bloom. *Iron and Steel Engineer,* v. 33, no. 12, Dec. 1956, p. 141-147.

Factors include oxygen cost, flame propagation rates, operational man hours and maintenance. Acetylene was selected in the plant described. (F21e, RM-g33)

25-F. Cold Forged Superalloys. *Steel,* v. 139, Dec. 3, 1956, p. 126.

Variety of parts cold forged to close tolerances show high finish and excellent flow pattern. (F22, T7; SGA-h)

26-F. Rolling and Forging of Zirconium. R. S. Stewart and W. C. Greenleaf. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 19-23. (CMA)

Zirconium will be processed mainly on rugged, high-production steel mill equipment for some time, but this is satisfactory if operators are specially trained. Zirconium has a wide hot workability range. Quenching hardens but slightly. Descaling of tight oxide must be mechanical. The reduction of zirconium ingots to billets, slabs or bars is accomplished on heavy-duty forging hammers or presses; small ingots may be cogged on small blooming mills. Preheating, forging and post-annealing are discussed. Rolling operations and sizes and shapes of billets and bars are enumerated. Fabrication of cold-rolled strip on modern continuous strip mills is described. (F23, F22; Zr)

27-F. Drawing and Extrusion of Zirconium. R. S. French. Paper from "Zirconium — Technology and Economics". Atomic Industrial Forum, p. 25-27. (CMA)

After casting zirconium into billets, the usual method of hot breakdown into tubes is through extrusion, involving lamellar flow by means of a 45° cone placed before the die; 2200 and 2450-ton universal presses with 6-in. diameter liners are used. Billet preparation is needed. The slow operation of tube reducing follows extrusion. Cold drawing is used for finishing; essentials are good lubricant, a good undercoat and a reasonable drawing speed. Straightening is complicated by the stiffness of zirconium. (F24, G4; Zr)

28-F. Zirconium Products. E. A. Wright. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 95-99. (CMA)

Wolverine Tube Division of Calumet and Hecla, Inc., has pioneered in fabrication techniques for zirconium and zirconium alloys. The metal should not be extruded into tubes without first being jacketed in copper, red or yellow brass or Ti-namel steel; any surface alloy formed must be removed. Many sizes of zirconium billets have been extruded. Many problems must be solved before zirconium tubes can be formed by rotary piercing. Lubrication and annealing problems discussed. (F24, 4-10; Zr)

29-F. High-Speed Rolling Mill; Cold Rolling Tinplate Production at EBBW Vale. *Electrical Review,* v. 159, Dec. 14, 1956, p. 1083-1087.

Welsh mill rolls strip at 5000 ft. per min. Plant also contains a two-stand tandem temper mill capable of 4000 ft. per min. (F23, 1-17, W22; CN)

30-F. Rolling Mill Operation. Use of New Recording Techniques. E. A. Chard, W. W. Hastings, D. F. Nettell and A. M. Mech. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 605-608.

Punched tape technique and analysis of tape; channel recorder technique, its apparatus and operational use; analysis of charts. (F23, X14)

31-F. Time Characteristics of the Slabbing Mill. H. G. Jones, D. T. Steer and P. D. Dickerson. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 608-612.

Analysis of rolling components; time in contact with rolls; time out of rolls not tilting and with tilting; time to roll an ingot and influence of rolling speed. (F23, 4-2, 3-17)

32-F. Some Effects of Lubricants in Cold Rolling Thin Strip. J. C. Whetzel, Jr., and Charles Wyle. *Metal Progress,* v. 70, Dec. 1956, p. 73-76.

Maximum reduction of thin strip can be increased from 12 to 62% at the same rolling speed by changing the lubricant. (F23, 4-3; NM-h)

33-F. Magnetic Rolls Cut Crop Loss. *Steel,* v. 139, Dec. 17, 1956, p. 94.

Magnetic rolls position tubing for cropping. (F29p, W12; 4-10)

34-F. Forming Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 366-372.

Fourteen of the industry's executives contribute to a symposium on progress. A few of the changes mentioned are growth of powder metal industry, hot extrusion of finish products, improved lubrication for severe forming operations and more complex bending equipment.
(F general, G general, H general)

35-F. New Techniques and Equipment Permit Broader Applications of Rotary Swaging. Andrew E. Rylander. *Western Machinery and Steel World,* v. 47, Dec. 1956, p. 64-67.

Improvements include greater opening of dies permitting entry of bulbous parts, longer dies, use of four dies, and hydroform swaging. (F25)

36-F. (Russian.) **Investigating the Conditions of Titanium Alloy Rolling.** V. K. Belesevich, et al. *Izvestiva Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk,* no. 10, Oct. 1956, p. 15-27.

Investigation of a two-component alloy of titanium with aluminum used in rolling sheet. The microstructure, gas saturation, plasticity, resistance to deformation during rolling, properties and the change in properties in relation to rolling temperature of the alloy are studied. (F23, M27, Q general; Ti, *Al*)

G Secondary Mechanical Working

Forming and Machining

11-G. How to Find the Cheapest Machining Methods. Robert T. Hook. *American Machinist,* v. 100, Dec. 31, 1956, p. 72-75.

The most productive approach to cutting costs, except for replacement of old machine tools, is in changing cutting tools, machining methods and in choice of materials. (G17, A4s)

12-G. High Speed-Heavy Feed Combo . . Boosts USSR Output. *American Machinist,* v. 100, Dec. 31, 1956, p. 76-80.

Machine tool cutting with up to ½ and ¾ in. per revolution, at higher than normal surface speeds raised productivity in some shops more than 50%. (G17)

13-G. Cold Extrusion of Special Nuts Cuts Costs 50%. Olaf Stepanek.

American Machinist, v. 100, Dec. 31, 1956, p. 88-90. (From *Czechoslovak Heavy Industry,* No. 5, 1956.)

Manufacture of wheel nuts with hydraulic presses originally developed for working thermoplastics. (G5, T7f)

14-G. Here's How We Designed an Automated Plant. R. L. Hiller. *American Machinist,* v. 100, Dec. 17, 1956, p. 105-109.

New G. E. "55" motor plant in Schenectady uses straight-line flow of parts from coiled steel, used for punchings, to complete motors. (G general, 18-24)

15-G. Car Wheel Manufacture: High-Rate Production of the Works of Joseph Sankey and Son, Ltd. *Automobile Engineer,* v. 46, Dec. 1956, p. 526-533.

Rolling of rims; welding of circles; assembling and finishing of wheels. (G11, K general, T21)

16-G. Automatic Flame Cutting Closes the Design-Production Gap. Robert N. Williams. *Industry and Welding,* v. 30, Jan. 1957, p. 68-71.

Produces accurate parts suitable for welding at a rapid rate; permits initial model changes to be made cheaply. (G22)

17-G. Rugged Carbide Tools Speed Die Block Machining. F. W. Lucht and T. Kreuzer. *Iron Age,* v. 178, Dec. 20, 1956, p. 78-79.

Suggestions on best procedure for quickly removing excess stock in large dies with use of carbide tipped face milling cutters. (G17b, W25)

18-G. When to Convert to Stamping. Federico Strasser. *Iron Age,* v. 178, Dec. 20, 1956, p. 84-87.

Determination by use of functional designs when stamping the part will be an improvement compared to casting, forging or machining. (G3, 17-1)

19-G. Ductile Spring Steel Withstands Severe Forming. *Iron Age,* v. 178, Dec. 20, 1956, p. 90.

Composition and advantages of special spring steel for automotive piston ring. (G general, T21; ST, SGA-b)

20-G. Draw Bending Keeps Output Up, Costs Down. S. L. Santillo. *Iron Age,* v. 178, Dec. 27, 1956, p. 58-59.

Automatic draw bending allows accuracy within ± ½° for 800 bends hourly in tubing or bar stock. (G6, 4-5, 4-10)

21-G. Cold Extrusion of Titanium. A. M. Sabroff and P. D. Frost. *Light Metal Age,* v. 14, Dec. 1956, p. 19-20.

Advantages of cold extruding titanium are strengthening through work hardening, time and material savings, good tolerances and finish, and production of an uninterrupted fiber flow. A surface treatment was developed by Battelle for titanium extrusion. material; an adherent, continuous coat is provided by immersion in a fluoride-phosphate bath. Cold extrusion studies were carried out on titanium grades AMS 4900 and AMS 4921. Working pressures are comparable with those in cold extruding steel. Data are tabulated and curves are shown. (G5; Ti)

22-G. Forming 6Al-4V Titanium Alloy. A. G. Lucas. *Light Metal Age,* v. 14, Dec. 1956, p. 21-24, 42. (CMA)

Ti-6Al-4V sheet can be formed on typical equipment at both room and high temperatures, and this fact is applied by Boeing in airframe construction. Forming must be complete enough to allow cold clamping of the part in the aging treatment (4 hr. at 1000° F.); the fixture used is described. Most Ti-6Al-4V forming is done in the annealed state. At 6t bend radius is possible with conventional equipment at 68° F. A formability index is shown graphically which compares Ti-6Al-4V with RC-70 and other titanium alloys. (G general, Q23q; Ti)

23-G. Fuel Injectors Call for Microscopic Methods. John Hedges. *Machinery,* v. 63, Jan. 1957, p. 127-131.

Techniques for production, finishing and inspection. (G general, L general, S general, W11)

24-G. "Mastering" Master Gears. Martin A. Hartman. *Machinery,* v. 63, Jan. 1957, p. 134-140.

Preparation of spur and helical external master gears: composition, tolerances, forming, grinding and inspecting. (G17, G18, T7a)

25-G. Fabrication of Aluminum: Press Forming, Roll Forming, Forging. V. A. McChesny. *Modern Metals,* v. 12, Dec. 1956, p. 66-73.

Factors determining alloy selection, forming or forging method, design and lubrication of die and annealing. (G1, G11, F22, J23; Al)

26-G. Aircraft Bolt Production Stepped up 16 Times. *Pacific Factory,* v. 86, Dec. 1956, p. 30. (CMA)

Voi-Shan Manufacturing Co. (Culver City) switched to cemented carbide dies in hot heading titanium aircraft bolts and increased production 16 times. The increase is attributed to improved resistance to galling and seizing. Hot heading is used in preference to cold heading because of the superior physical qualities of the fastener. The process is described. Special precision-built Carboloy grade 190 dies last as long as 50,000 bolts before failure. (G10, T7; Ti)

27-G. Conventional Equipment Adapted to Special Forming Problem. *Pacific Factory,* v. 86, Dec. 1956, p. 32. (CMA)

Titanium alloy sheet is formed on conventional equipment by Boeing. Integrally heated toolsteel dies show promise of being adaptable to drop-hammer operations; a flame-sprayed coating of Ni-Cr-B is appplied as a lubricant. One punch thus protected has not shown corrosion or wear damage. Electric heat is used for heating blank sheet, but premixed gas heat is preferable for integrally heating the larger tools. While forming problems remain, Ti-6Al-4V has been successfully formed into complex shapes. (G general, F22n, W23; Ti)

28-G. Wrap-Around Eases Bending Chores. *Steel,* v. 139, Dec. 3, 1956, p. 136.

Stretch forming machine maintains contours of a thin corrugated aluminum sheet bent 180°. (G9; Al)

29-G. The Use and Properties of Non-Flammable Liquids in Manufacturing Process. David Milne. *Steel Processing,* v. 42, Dec. 1956, p. 686-691, 714.

Necessary properties of liquids used for hydraulic fluids, machining operations, metal cleaning, sound deadeners, rustproofing, stretcher rolling operations, painting operations and quenching of heat treated metals. (G general, L general, J26, 1)

30-G. Phases of Hole Grinding. Part I. John E. Hyler. *Steel Processing,* v. 42, no. 12, Dec. 1956, p. 695-699.

Consideration of methods, machines and problems in internal grinding. (G18j)

31-G. Bending by Rolling of Ferrous and Non-Ferrous Plate. Part 1. E. L. Tinley. *Welding and Metal Fabrication,* v. 24, No. 12, Dec. 1956, p. 452-455.

Various forms in which designs of roller bending machines have been developed to meet the varied requirements of the plate fabricating industry. Reference chart indicating best applications for machine types. (G11; ST, 4-3)

32-G. The Zirconium Program at Bridgeport Brass Company. R. S. French. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 69-71. (CMA)

The interest of Bridgeport Brass in zirconium has, until recently, been one of research in deep drawing zirconium shells. A means of making zirconium tubes ranging from 3-in. extrusions to ⅜-in. sizes (cold drawn); rod has also been extruded. Problems of analysis and annealing discussed. (G4b, F24; Zr)

33-G. German Production Methods Today. William F. Schiecher. *Machine and Tool Blue Book,* v. 52, Jan. 1957, p. 103-112.

Progress of German industry, particularly the machine tool industry, since World War II. (G general)

34-G. How Ford Increased Production With Ceramic Tools. *Machine and Tool Blue Book,* v. 52, Jan. 1957, p. 140-143.

Since applying cemented oxide tools, changes have been reduced, cycle time reduced, machine speeds increased and finishes improved. (G17, T6, 6-20)

35-G. Some Observations With the Electric Spark Machining Process. G. R. Wilms and J. B. Wade. *Metallurgia,* v. 54, Dec. 1956, p. 263-268.

A study of spark machining of aluminum, antimony, chromium and iron and of resultant cracking and deformation. 14 ref. (G24a; Al, Sb, Cr, CI)

36-G. When to Consider Aluminum Cold Extrusions. R. A. Guadt. *Pacific Factory,* v. 86, Dec 1956, p. 26-27.

Six factors to consider when designing toward cold extruusion; alloys and finishes available. (G5, 17-1, Al)

37-G. Better Metals Formed on Improved Presses and Dies. *Production,* v. 39, Jan. 1957, p. 115-120.

Description of new Chrysler stamping plant at Twinsburg, Ohio. (G3)

38-G. Machining Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 332-350.

Twenty-one of the industry's executives outline recent developments. A few of these advances are increasing use of tape and card controls in small lot production shops, greater use of surface grinders, ceramic tooling factor in future tool design. (G17, G18, G19, G24)

H Powder Metallurgy

5-H. Metal Powder Parts Get New Look. *Steel,* v. 139, Dec. 3, 1956, p. 121-124.

Intricate and larger parts made possible by multiple motion presses increase use of metal powder products. (H14)

6-H. Powder Metallurgy of Zirconium. H. S. Kalish. Paper from "Zirconium — Technology and Economics". Atomic Industrial Forum, p. 29-33. (CMA)

Zirconium powder prepared by decomposition of ZrH is irregular and somewhat sintered together, that from leaching zirconium produced by magnesium reduction is spheroidal and uniform, and that from calcium reduction of ZrO_2 is lacy and agglomerated. Leached sponge is more free from oxygen and nitrogen than the others. Basic methods of fabricating zirconium powders are enumerated and described. Cermets are produced from zirconium powders. A Zr-U system of alloys made by powder metallurgy has been studied. (H general; Zr)

7-H. Infiltration of Cermets for Improved Toughness. Claus G. Goetzel and John B. Adamec. *Metal Progress,* v. 70, p. 101-106.

Composite structures produced by impregnating porous titanium carbide compacts with a metallic binder have better impact strength and oxidation resistance than conventional cermets. (H16e, 6-20)

J — Heat Treatment

21-J. Modernization Can Cut Costs in Annealing Malleable Iron. Carl L. Ipsen. *Foundry,* v. 85, no. 1, Jan. 1957, p. 104-109.

Benefits obtained by modern heat treating furnaces, which are designed to provide temperature control, controlled atmosphere, flexibility in speed of production.
(J23, W27; CI)

22-J. How to Get More Out of Beryllium Copper. John T. Richards. *Materials and Methods,* v. 44, no. 6, Dec. 1956, p. 112-114.

New heat treatments described and influence of beryllium content, rolled temper, aging temper, heating rate during aging, metal thickness and grain direction summarized.
(J27d, Cu, *Be*)

23-J. Current Heat-Treatment Practice. R. J. Brown. *Metal Treatment And Drop Forging,* v. 23, Dec. 1956, p. 503-511.

Current furnace types; examples of all types of heat treatment.
(J general, W27)

24-J. Fine Grained Brass for Deeper Draws. *Steel,* v. 139, Dec. 24, 1956, p. 66-67.

Continuous annealing of brass strip gives superior ductility and allows fine finish.
(J23, 1-11, Q23p; Cu)

25-J. The Metallographic View. Point 29. Nitriding the Lower Alloy Steels. Howard E. Boyer. *Steel Processing,* v. 42, Dec. 1956, p. 700-701, 708.

Special alloy steels have the best nitriding properties, but a member of conventional alloy steels containing chromium, vanadium, manganese or molybdenum respond to ammonia gas nitriding. (J28k, M27; AY)

26-J. The Heat Treating Pilot Plant—A New Industrial Aid. H. Ross. *Steel Processing,* v. 42, Dec. 1956, p. 705-708.

Use of pilot plant enables manufacturers to anticipate and meet problems arising in commercial production; stimulates research.
(J general, A9j)

27-J. Gear Hardening Unit Brings Operating Savings. *Western Metals,* v. 14, Dec. 1956, p. 53-54.

Flame hardening of winch gears results in superior products and lower costs. (J2h, T7)

28-J. (French.) **Control Problems in Surface Hardening by Induction.** C. Di Pieri. *Metallurgie et la Construction Mecanique,* v. 88, no. 11. Nov. 1956, p. 931-937.

High-frequency electronic generators; matching loads, regulation of inductor current and control of generator power. (J2g, W28)

29-J. (Japanese.) **Heating of Aluminum Alloys.** Tadakazu Hatori. *Metals,* v. 26, Dec. 1956, p. 964-965.

Heat absorption characteristics of aluminum alloys, methods of heating, soaking time. (J2, P11k; Al)

30-J. Tempering of Plain Carbon Steels. E. D. Hyam and J. Nutting. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 638-644.

Mechanical properties and microstructure; experimental methods for metallographic examination; microstructural analysis; Meyer index determinations and carbide particle size distributions.
(J29, N8a, Q29, CN)

31-J. Fourth Stage of Tempering. Kehsin Kuo. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 645-650.

Experimental method for electrons, microscopic examination of alloy carbides precipitated, especially for molybdenum steels, vanadium and titanium steels and chromium steel; hardness measurements with increasing tempering temperature.
(J29, N8r, Q29; AY)

32-J. Tempering and Nitriding of 3% Chromium Steels. C. C. Hodgson and H. G. Baron. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 623-628.

Influence of tempering temperature, duration of tempering and the carbon content of the steel on the response to nitriding of steels differing essentially only in carbon content. (J29, J28k; AY, *Cr*)

33-J. Safe Operation of Atmosphere Furnaces. J. Huebler. *Metal Progress,* v. 70, Dec. 1956, p. 79-83.

Furnace user's responsibility is to see that the equipment is in perfect working order, and to provide competent well-educated operators. Responsibilities of the manufacturer. 6 ref. (J2k, A7p, W27)

34-J. Heat Treating Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 292-304.

Twenty of the industry's leaders briefly point out progress and trends. A few of the trends are more automation in heat treating, automatic atmosphere control, more compact furnaces.
(J general, W27, W28)

35-J. (Russian.) **Investigating the Recrystallization of Titanium and Its Alloys. Effect of Annealing Temperature on the Mechanical Properties and Microstructure of Titanium.** Ye. M. Savitsky and M. A. Tylkina. *Investiya Akademii Nauk SSSR, Otdelemiya Tecknicheskikh Nauk,* no. 10, Oct. 1956, p. 125-127.

Effect of annealing temperature in the range of 600-1300° F. on the structure and the mechanical properties of deformed titanium. Prior to tension and impact resistance tests, the iodic and magnothermic titanium specimens were annealed at 600, 700, 900, 1000, 1200 and 1300° F. for 1 hr. in evacuated quartz ampoules. (J23c, Q general, 2-14; Ti)

K — Assembling and Joining

25-K. Automatic Welding Speeds Fabrication of Lake Vessel Sub-Assemblies. *Industry and Welding,* v. 30, Jan. 1957, p. 52-54, 64.

Automatic welding saved 20% in welding time on hull and housing of freighter "George M. Humphrey".
(K1, T22)

26-K. Redesign for Projection Welding Yields First Space Saving Rectangular Motor. *Industry and Welding,* v. 30, Jan. 1957, p. 58-63.

New small accessory motor of rectangular shape made possible by projection welding. (K3q)

27-K. Solder Aluminum to Other Metals. Kenneth V. Lutz. *Industry and Welding,* v. 30, Jan. 1957, p. 74-79.

New soldering alloys and fluxes make it possible to join aluminum to steel, stainless steel, Monel, nickel, copper and brass. (K7; Al, SGA-n)

28-K. Welded Umbrella Supports Stadium Shell. *Iron Age,* v. 178, Dec. 20, 1956, p. 83.

Self-supporting welded steel shell built at Georgia Tech.
(K general, T26)

29-K. Flash Weld Titanium to High Strengths. *Iron Age,* v. 178, Dec. 27, 1956, p. 57.

Procedure for welding titanium similar to that used for steel except a low upset pressure is best.
(K3r; Ti)

30-K. Tips for Ultrasonic Soldering of Aluminum. Ralph Reynolds. *Light Metal Age,* v. 14, Dec. 1956, p. 16.

Metals suitable for ultrasonic soldering; suggestions for obtaining the best results include cleaning, preheating and lacquering all soldered areas likely to be exposed to adverse weather. (K7; Al)

31-K. Soldering Keeps Up to Date. *Steel,* v. 139, Dec. 17, 1956, p. 86-90.

New solders and techniques used in joining materials such as stainless, titanium, molybdenum, aluminum, glass and ceramics; usage of ultrasonic equipment.
(K7, W29; SS, Ti, Mo, Al)

32-K. This Building Is Welded. *Steel,* v. 139, Dec. 24, 1956, p. 64-65.

Frame for 19-story office building welded with automatic submerged-arc welder. (K1e, T26; ST)

33-K. Inert-Tungsten-Arc Butt Welding of Zircaloy-2 Tubes. J. W. Lingafelter. *U. S. Atomic Energy Commission.* *HW*-43049, Aug. 1, 1956, 23 p. (CMA)

A 52-ft. internally ribbed tube of Zircaloy-2 was butt welded from three smaller sections by the inert-tungsten-arc method, using a copper backup plug. The joints were fully penetrated and contained no significant porosity or contamination. Equipment and welding procedure described. (K1d; Zr, 4-10)

34-K. Fusarc/CO_2, a New Welding Process. E. J. Mitchell and W. E. Freeth. *Welding and Metal Fabrication,* v. 24, No. 12, Dec. 1956, p. 431-438.

New development in arc welding in which a continuous covered electrode of special design is deposited under a shield of CO_2. The com-

bined use of flux and gas shielding enables a unique combination of metallurgical and operational properties to be obtained at high welding speeds. (K1)

35-K. Welding Technology in the U.S.S.R. *Welding and Metal Fabrication*, v. 24, No. 12, Dec. 1956, p. 439.

Electro-slag method being used by 25 plants for welding heavy plate and large sections. Automatic metal-arc welding widely used, 40% of welding in U.S.S.R. being automatic. Gamma-ray equipment has largely displaced X-ray equipment in shipyeard inspection work. (K1, S13e, T-22; 4-3)

36-K. Equipment for Metal Bonding. R. A. Johnson. *Welding and Metal Fabrication*, v. 24, No. 12, p. 447-451.

Types of adhesives and methods for applying heat and pressure. (K12)

37-K. Time-Temperature Dependence of Austenitic Stainless-Steel Welded Joint Components. J. Heuschkel. *Welding Research*, v. 21, Dec. 1956, p. 569-581.

Relation of "weldability" to ductility, composition, microstructure and its orientation. "Weldability" ideal defined. 22 ref. (K9n, 17-2; SS)

38-K. Metal Finish Seam Welding. W. J. Allen and M. L. Begeman. *Welding Research*, v. 21, Dec. 1956, p. 597s-603s.

Considerable similarity found between schedules for mash seam welding and finish seam welding; with proper conditions a good finish surface can be consistently maintained on one side of sheets. (K3p)

39-K. The Welding of High-Strength Aluminum Alloys in Heavy Sections. Willis G. Groth and Richard A. Matuszeski. *Welding Research*, v. 21, Dec. 1956, p. 616s-622s.

Investigations indicate that 5154 and 5056 aluminum alloys in heavy sections handle satisfactorily and have mechanical property advantages over 6061 alloy for many applications. (K general, Q general; Al)

40-K. A Dew Point-Temperature Diagram for Metal-Metal Oxide Equilibria in Hydrogen Atmospheres. W. H. Chang. *Welding Research*, v. 21, Dec. 1956, p. 622s-624s.

New diagrams for use as a guide for furnace brazing in hyrogren atmospheres. 6 ref. (K8j, N15a; H)

41-K. Plasticity Committee. Paul Ffield. *Welding Research Council Yearbook*, 1956, p. 18.

A manual on the design and fabrication of large field-welded engineering structures has been prepared and will be available soon. (K general, T26, 18-17)

42-K. Structural Steel Committee. LaMotte Grover. *Welding Research Council Yearbook*, 1956, p. 27-31.

The following projects are discussed: wedge beam investigation at Columbia University, welded interior beam and column connections at Lehigh University, and transfer of stresses in welded cover plates at University of Florida. (K general, T26; ST, 17-1)

43-K. Resistance Welding Research Committee. John F. Randall. *Welding Research Council Yearbook*, 1956, p. 34-38.

Investigations underway: series spot welding and flash welding at Rensselaer Polytechnic Institute; seam welding at University of Texas; fatigue of spot welding at Ecole Polytechnique; and contact resistance welding at Johns Hopkins University. (K3, A9)

44-K. Welding Procedures Committee. L. J. Larson. *Welding Research Council Yearbook*, 1956, p. 40-41.

The project on postheat or thermal stress-relieving treatments has been given highest priority. (K9q, J1a)

45-K. High Temperature Braze Process Versatile Tool for Jet Engine Metals. John V. Long, George D. Cremer and Richard S. Mueller. *Western Metals*, v. 14, Dec. 1956, p. 58-61.

Applications of brazed assemblies in compressor, combustor, turbine and after-burner areas of jets. (K8, T24b; SGA-h)

46-K. (Japanese.) **Welding Agents for High Speed Steel.** Hidetsugu Tada. *Metals*, v. 26, Dec. 1956, p. 966-968.

Methods of welding using welding agents; experimental results. (K general; TS)

47-K. Butt-Weld Tooling for Thin Gauge Aluminum. Gilbert C. Close. *Light Metal Age*, v. 14, Dec. 1956, p. 17-18.

Deals with the "chill-shunting theory" used in butt-welding thin-gage aluminum, and the weld tooling that makes application of this theory possible. (K1d, W29; Al)

48-K. Semi-Automatic Welding Cuts Production Costs. Charles F. Ayers. *Pacific Factory*, v. 86, Dec. 1956, p. 22-23.

Versatility has been achieved by turning jigs for the position of the work, and hand-held "dams" for the containment of the hot-flowing flux. (K1e, W29)

49-K. Joinings and Assembly Forum on Technical Progress. *Steel*, v. 140, Jan. 7, 1957, p. 386-394.

Short contributions by 22 executives in the industry on recent trends. A few of these are the trend in fasteners to closer tolerances and higher strengths, growing usage of silver alloy brazing, welding becomes more mechanized for greater productivity and metal bonding adhesive finds increasing acceptance. (K general)

50-K. (Russian.) **Automatic Electric Arc Welding of Titanium.** S. M. Gurevich, C. V. Mishehenko and Ye. O. Paten. *Avtomaticheskaya Svarka*, No. 5, Sept.-Oct. 1956, p. 1-12.

Technology of electric-arc welding of titanium with nonconsumable electrode in an inert-gas stream; characteristics of automatic welding of titanium under flux; data on the structure and mechanical properties of weld seams. (K1d; Ti)

51-K. (Pamphlet—Russian.) **Soldering of Aluminum and Its Alloys With the Use of Ultrasonic.** G. I. Apukhtin. *Informatsjya O Nauchno-Issledovatel' skikh Robotakh* (Information on Research Works), No. I-56-3, Moscow, 1956.

New method for soldering aluminum and its alloys, with the aid of ultrasonics, in which mechanical cleaning of the surfaces is supplanted by the phenomena of cavitation in the fused solder produced by ultrasonic vibrations in the soldering iron tip. Generation of the vibrations is accomplished by means of magnetostrictional vibrators. Table of special solders, their contents and properties, and schematic drawings of the equipment are included. This method may be adapted to ferrous and nonferrous metals. (K7h; SGA-f)

L Cleaning, Coating and Finishing

39-L. Latest Equipment Displayed at Metal Finishing Show. *Automotive Industries*, v. 115, Dec. 15, 1956, p. 70-72.

Display of coated abrasive equipment at Metal Finishing Show; use of coated abrasives for polishing metal parts having difficult contours. (L10b; NM-j)

40-L. Pickle Liquor Recovery. *Chemical and Engineering News*, v. 35, Jan. 7, 1957, p. 64-65.

New processes eliminate waste problem, keep acid content of pickling bath uniform, increase pickling capacity, reduce sulphuric acid consumption. (L12g, A8b)

41-L. Protecting Steel From Rust: Results of Surface Treatment Tests. *Corrosion Technology*, v. 3, Dec. 1956, p. 393-396.

Pretreatment of surface prior to painting to remove or neutralize rust is recommended. (L10, L12, R11)

42-L. New Hot-Dip Galvanizing Plant. *Corrosion Technology*, v. 3, Dec. 1956, p. 397-399.

Ideal Casements Ltd. plant at Reading, England, incorporates several new ideas. (L16, 10-5, Zn)

43-L. Yorkshire Firm's Pickling and Painting Plant. *Corrosion Technology*, v. 3, Dec. 1956, p. 400.

Equipment and processes of the Rose Mount iron works of Robert Dempster and Sons Ltd. (L12g, L26n, W3, 10-5; Fe)

44-L. Automatic Cleaning Unit Adapted to Job Shop Use. Eugene F. Anderson. *Foundry*, v. 85 no. 1, Jan. 1957, p. 224-226.

Abrasive blasting for castings unsuitable for tumbling. (L10c; 5)

45-L. Hard-Facing Doubles the Life of Coal Crusher Teeth. *Linde Tips*, v. 36, no. 1, Winter 1957, p. 18.

Cobalt-chromium-tungsten rod is used for hard-facing new teeth, chromium-magnesium-iron rod for rebuilding worn and broken teeth. (L24, W15; AY; 18-22)

46-L. Protecting Molydenum at High Temperatures. J. J. Harwood. *Materials and Methods*, v. 44, No. 6, December 1956, p. 84-89.

The reason for molybdenum protective coating for high temperature. Methods of coating; (1) electrodeposited coating such as nickel plate, chromium plate, and chromium-nickel plate; (2) cladding; (3) sprayed metal coating; (4) diffusion coating; (5) molybdenum disilicate coating; (6) ceramic coating. Results of oxidation rate with temperature, time and thickness of coatings. (L general, 2-12; Mo)

47-L. Acrylic Coatings for Metal Products. Gerould Allyn. *Materials and Methods*, v. 44, no. 6, Dec. 1956, p. 106-109.

Clear lacquers and pigmented enamels are used to preserve attractive metallic surfaces, protect electronic circuits from moisture, protect chemical and food processing equipment and provide a finish that maintains its color at elevated temperatures. (L26p)

48-L. Fast. .Hard. .Ductile Chrome Plate. *Modern Metals,* v. 12, Dec. 1956, p. 76-77.

Wide range of uses for "Hardalume" processed metal; process deposits chromium directly on aluminimum. (L17; Al, *Cr*)

49-L. Finishes for the Bottle Crown Industry. Part 2. Application Controls and Testing Procedures. Louis F. Rogers. *Organic Finishing,* v. 17, Dec. 1956, p. 5-9.

Quality control in the application of size, enamel and varnish coating to bottle crowns. (L26n)

50-L. Variables Affecting Coating Performance. Part 3. John I. Richardson. *Organic Finishing,* v. 17, Dec. 1956, p. 10-11, 21.

Ease of handling, flexibility, maintenance and costs. (L26, 17-2)

51-L. Laboratory Control of Color Anodizing Process. Frank P. Stiller. *Plating,* v. 43, Dec. 1956, p. 1419-1421.

Analytical procedures for electrolyte dye solution and sealing bath. (L19, S11)

52-L. New Directions for Porcelain Enamel. *Steel,* v. 139, Dec. 3, 1956, p. 142, 147.

New developments in enameling on aluminum and aluminized steel consist of low-temperature frits, convection heated furnaces and electrostatic spraying. (L27, Al, ST)

53-L. Descaling Titanium Sheet. W. J. Barth. *Steel,* v. 139, Dec. 31, 1956, p. 62-63. (CMA)

Du Pont laboratory tests which studied an oxidizing fused caustic bath for removing inert scale on titanium sheet. The descaling time at 800° F. varies from ¾ to 10 min.; attack on the base metal is low and hydrogen adsorption is slight. Straight caustic soda is too severe but the dilution with sodium nitrite and nitrate (8%) slows attack. Temperatures over 800° F. should be avoided. Additives to minimize sheet firing were investigated. (L12n; Ti, 4-3)

54-L. (French.) **Surface Treatments for Zamaks.** *Fonderie,* No. 129, Oct. 1956, p. 418.

Baths for cleaning, brightening and coloring Zamak zinc alloys which have become corroded on storage. (L12; Zn)

55-L. Stress in Electrodeposits. R. Pinner. *Electroplating and Metal Finishing,* v. 9, Dec. 1956, p. 391-396.

Causes, methods of measurement, normal values obtained in different types of plating solutions, effects of substrate, deposit thickness, solution composition and impurities. (To be continued.) (L17b, Q25)

56-L. Operation Units and Unit Phases in Electroplating. J. M. Alameda. *Electroplating and Metal Finishing,* v. 9, Dec. 1956, p. 397-399.

Breakdown of operations into operation units and unit phases would facilitate development of new products and processes and simplify application, and cost estimation. (L17, A5c, 17-3)

57-L. Cleaning by Ultrasonics. J. Lomas. *Machinery Lloyd (Overseas Edition),* v. 28, Dec. 8, 1956, p. 94-96.

Effect of ultrasonics is largely owing to the mechanical scrubbing action from the enormous number of microscopic bubbles which form and immediately collapse. One of its greatest advantages is that it reaches surfaces not easily accessible. (L10f)

58-L. Surface Treatment of Titanium. H. Richaud. *Metal Industry,* v. 89, Dec. 14, 1956, p. 496-497. (CMA)

The surface treatments necessary for successful electrodeposits on titanium discussed. Pickling is the first operation and three processes are available: HF-HCl and HF-HNO_3 solutions and molten NaOH-4%$NaNO_3$ (Virgo). Solvent degreasing, generally with trichloroethylene, follows. Anodizing may now be performed using sulphuric or phosphoric acid baths; the color obtained varies with electrolysis time. For electrodeposition of copper, chromium, nickel brass, silver or cadmium, another pickling and an anodic etch are required. Uses of electrodeposited titanium are outlined. (L general; Ti)

59-L. Conservation of Nickel in Electroplating. V. L. McEnally, Jr., and F. G. Brune. *Metal Progress,* v. 70, Dec. 1956, p. 89-96.

One third of the nickel used in electroplating would be saved if deposits of uniform thickness could be obtained. Some techniques for improving uniformity are described. (L17b, A11; *Ni*)

60-L. Continuous Parts Plating. *Production,* v. 39, Jan. 1957, p. 104-105.

Ornamental die castings are manually loaded onto plating carriers according to a pre-established loading pattern for continuous automatic cycling through successive tanks. (L17, 18-24, 1-11)

61-L. Cleaning and Finishing Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 374-384.

Twenty-six authorities in the field contribute brief comments on important developments. A few trends mentioned are changing application procedures reduce material wasted, procedures become more automatic, improved electrostatic painting equipment. (L general)

62-L. (German.) **Merits of Lacquered Sheet Metal Cans in Relation to the Annealing Temperature of the Lacquer.** J. Herrmann and B. Mueller. *Die Technik,* v. 11, Nov. 1956, p. 773-776.

Importance of annealing temperature and time as applied to the application of the base lacquer in relationship to the subsequent application of the cover lacquer of tin cans. (L26n, 2-14)

M Metallography

Constitution and Primary Structures

43-M. The Constitution of Copper-Rich Alloys of the Copper-Manganese-Aluminium System. D. R. F. West and D. Lloyd Thomas. *Institute of Metals, Journal,* v. 85, No. 3, Nov. 1956, p. 97-104.

Constitution of copper-based alloys containing approximately 0-30 wt. % manganese and 0-18 wt % aluminum within the temperature range 800 to 400° C. Results presented in the form of isothermal sections. 20 ref. (M24c; Cu, Mn, Al)

44-M. Lattice Spacings of the Silver-Rich Solid Solution Containing Magnesium and Antimony. R. B. Hill and H. J. Axon. *Institute of Metals, Journal,* v. 85, No. 3, Nov. 1956, p. 109-116.

Measurements of the lattice spacings. Silver-rich solution comes into equilibrium with three compound phases. Atom-size considerations are discussed. 13 ref. (M26p; Ag, Mg, Sb)

45-M. Microstructure: Guide to Better Alloys. W. R. Hibbard, Jr. *Iron Age,* v. 178, Dec. 20, 1956, p. 75-77.

New alloys can be designed on basis of microstructures offering optimum properties needed from materials; this is much quicker than usual approach. (M27, 17-1)

46-M. Structure of Bent Zinc Crystals. C. T. Wei and Paul A. Beck. *Journal of Applied Physics,* v. 27, Dec. 1956, p. 1508-1518.

Structure was studied by X-ray diffraction techniques. Zinc crystals, after being bent, were subdivided into subgrains. (M26n; Zn)

47-M. "Lozenge" and "Tadpole" Domain Structures in Silicon Iron Crystals. L. F. Bates and P. F. Davis. *Physical Society Proceedings,* v. 69, Pt. 11, Nov. 1, Sect. B, 1956, p. 1109-1111.

New photographs of these patterns are recorded and models are given for their interpretation. (M27g; Si, Fe)

48-M. (English.) **Resistometric and Calorimetric Studies on the Precipitation in Aluminum-Silver Alloys.** G. Borelius and L. E. Larsson. *Arkiv Fur Fysik,* v. 11, no. 2, Feb. 22, 1956, p. 137-163.

Equilibrium phase diagram, formation of Guinier-Preston zones; resistivity-concentration diagram; diffusion mechanism. (M24b, N7b, N1c; Al, Ag)

49-M. (German.) **Observations on Peaks in 18-8 Cr-Ni Steel Under the Field Electron Microscope.** Ferdinand Stangler. *Zeitschrift der Physik,* v. 146, Oct. 1956, p. 496-504.

A process for etching 18-8 steel wire by electronic means. A simple apparatus permits uniform etching. Images obtained are reproducible, but clear meaning is still lacking. Various shapes of peaks were observed during annealing at the high voltage applied, on the basis of emission images. (M21e; SS)

50-M. (Japanese.) **On the Equilibrium Diagram of Titanium-Oxygen-Carbon System. II. The Titanium-Oxygen System.** H. Nishimura and H. Kimura. *Japan Institute of Metals, Journal,* v. 20, Sept. 1956, p. 524-528. (CMA)

The Ti-O system was studied by X-ray, microscopy and measuring the melting point. Emphasis was placed on the oxygen-rich portions of the diagram. The liquidus temperature of TiO (δ) phase decreases to 1750° C. as the oxygen content mounts. On the side of Ti_2O_3 (ε) the liquidus temperature again rises to a peritectic point at 1810° C. Solid solubility ranges of the δ and ε phases are discussed. Between ε and η (TiO_2) there occurs a eutectic reaction at 1680° C. and 36.5% O. 7 ref. (M24c; Ti)

51-M. (Japanese.) **On the Equilibrium Diagram of Titanium-Oxygen-Carbon System. III. On the Titanium-Carbon System.** H. Nishimura and H. Kimura. *Japan Institute of Metals, Journal,* v. 20, Sept. 1956, p. 528-531. (CMA)

The carbon-rich portion of the Ti-C phase diagram was emphasized in a study of the whole range of contents. The liquidus rises from the titanium melting point (1660° C.). When the carbon content exceeds 20% the liquidus again falls to a eutectic at 3050° C. and 26% C. Further increases of carbon in-

crease the liquidus to 3800° C., at which point an equilibrium between vapor and graphite vs. liquid occurs. (M24b; Ti)

52-M. (Japanese.) **On the Equilibrium Diagram of Titanium Carbon Oxygen System. IV.** H. Nishimura and H. Kimura. *Japan Institute of Metals, Journal,* v. 20, Oct. 1956, p. 589-592. (CMA)

The Ti-O-C diagram was studied by melting point measurement, chemical analysis, X-ray and microscopy. Solid phases occurring are α-Ti, β-Ti, carbon, δ(TiC-TiO), ε and η. β-phase is produced on the titanium-rich side by a peritectic reaction: Liquid $+ \delta + \alpha \rightleftarrows \beta$. δ is a continuous solid solution of TiC and TiO of NaCl-type structure. Three invariant reactions containing gaseous phases are believed to exist at 3000, 1800 and 1670° C. 4 ref. (M24c; Ti)

53-M. (Russian.) **Relationship of Composition, Temperature and Heat Stability. III. Quinternary System Alloys Nickel-Chromium-Tungsten-Aluminum-Titanium.** I. I. Kornilov and F. M. Titev. *Izvestiya Akademii Nauk SSSR Otdelentive Nauk,* No. 10, Oct. 1956, p. 117-122.

Relationship of composition, structure and heat stability of alloys of quinternary system nickel-chromium-tungsten-aluminum-titanium alloys in the temperature range from 600 to 1250°. All of the alloys had the same chromium, tungsten and aluminum content (20%, 6% and 4.5% respectively), while the titanium content varied with the nickel, from 0 to 10.0% (by weight). Smelting was conducted in a high-frequency laboratory furnace. (M24d, Q general, 2-12, 2-10; Ni)

54-M. (Russian.) **Concerning the Phase Composition of the System Boron-Carbon.** V. A. Epel'baum, M. A. Gurevion and B. F. Ormont. *Zhurnal Neorganicheskoy Khimii,* v. 1, Sept. 1956, p. 2149-2154.

Results of investigations dealing with phase relationships within the system boron-carbon. Results are of importance in connection with the manufacture of boron carbide. (M24e; B, NM-a35)

Transformations and Resulting Structures

50-N. The Calculation of Transformation Temperatures and Austenite-Ferrite Equilibria in Steel. K. W. Andrews. *Iron and Steel Institute, Journal,* v. 184, Dec. 1956, p. 414-427.

The theoretical basis from the standpoint of equilibrium diagrams; some qualitative and semi-quantitative relationships, equations for transformation temperatures. Specic applications, practical cases. 16 ref. (N8; ST)

51-N. Isothermal and Continuous-Cooling Transformation Diagrams of Steels. Part 2. G. Mayer. *Metal Treatment and Drop Forging,* v. 23, Dec. 1956, p. 495-498.

Determination of continuous-cooling diagrams; comparison of the usefulness of isothermal and continuous-cooling transformation data. 8 ref. (N8g; ST)

52-N. Zirconium Alloys. E. E. Hayes. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 51-54. (CMA)

Zirconium alloys are discussed generally; they are classed into three systems: α solid solution, β solid solution, and totally soluable. The two outstanding α additions, tin and aluminum, raise hot hardness and decrease workability. Large amounts of β additions are soluble, but cannot be retained at lower temperatures. The completely soluble additions, titanium and hafnium, have little value. The best zirconium alloys are the α-β alloys. Yield strengths, creep and elongation are considered. (N6p, Q23, 2-10; Zr)

53-N. (French.) **Various Forms of Graphite Found in Gray Cast Iron.** Michel Ferry. *Fonderie,* No. 126, Oct. 1956, p. 395-429.

The chraacteristics of graphite in gray cast iron as identified in the ASTM classification illustrated and tabulated. (N8s; CI)

54-N. (Japanese.) **Aging of Permanent Magnets.** Nabou Makino. *Metals,* v. 26, Dec. 1956, p. 918-922.

The reason for aging of permanent magnets; reduction ratio of retentivity for materials; effect of external conditions; effect of change in crystal lattice and by heat on retentivity. Methods of reducing aging. 8 ref. (N7, P16; SGA-n)

55-N. (Japanese.) **Kirkendall Effect.** Koda. *Metals,* v. 26, Dec. 1956, p. 950-952.

Kirkendall's experiments on diffusion of metals; nature of lattice vacancies; producing and diminishing vacancies. (N1c, M26s)

56-N. Determination of 1600 and 1700° C. Liquidus Lines in $CaO.2Al_2O_3$ and Al_2O_3 Stability Fields of the System CaO-$Al_2O_3.SiO_2$. Frederick C. Langenberg and John Chipman. *American Ceramic Society, Journal,* v. 39, Dec. 1, 1956, p. 432-433.

Liquidus lines determined from the chemical analyses of saturated slags at these temperatures. (N12; RM-g)

57-N. Carbides in Low-Alloy Steels. Experiments on Their Compositions. J. E. Bowers. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 628-630.

Determination of isothermal transformation curves; transformation diagnosis for several alloy steels. (N8g, N8r; AY)

58-N. Bainitic Retained Austenite . . "Conditioning" In En 40C and Occurrence in Other En Steels. J. A. Cameron. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 631-633.

Graphs and tables showing dilatometer deflections with temperature. (N8n; AY)

59-N. Martensite and Bainite. W. Steven and A. G. Haynes. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 634-638.

Errors inherent in assessing the proportions of untempered martensite in a structure; standard procedure for determining martensite formation ranges; influence of chemical composition on bainite reaction. (N8p, N8m; ST)

60-N. Diffusion of Aluminum in Single Crystal Silicon. R. C. Miller and A. Savage. *Journal of Applied Physics,* v. 27, Dec. 1956, p. 1430-1432.

Aluminum solid solubilities in the neighborhood of 10^{19} atoms per cc. found over the 1200 to 1400° C. temperature range. (N1e; Si, 14-11, *Al*)

61-N. Growth Bends in Iron Whiskers. George S. Baker. *Journal of Applied Physics,* v. 27, Dec. 1956, p. 1561-1562.

Bend caused by the whisker axis shifting from one crystal direction to another. (N3r; Fe)

62-N. Growth of Large Diameter Silicon and Germanium Single Crystals. W. R. Runyan. *Journal of Applied Physics,* v. 27, Dec. 1956, p. 1652.

Six-inch germanium and 4-in. silicon crystals were grown. (N3r; Si, Ge)

63-N. (Japanese.) **On the Recrystallization of Aluminum Alloys Containing Titanium.** I. Obinata and S. Kugasa. *Japan Institute of Metals, Journal,* v. 20, Oct. 1956, p. 533-536. (CMA)

The effect of titanium on the recrystallization behavior of Al-Mg alloys and cold-rolled aluminum was studied by X-ray and microscopy. Adding titanium raises the recrystallization temperatures by 50° C. up to 0.1-0.2% Ti; grain size after annealing is also refined. Recrystallization diagram. (N5f, 2-10; Al, *Ti*)

64-N. (Japanese.) **Study on the Grain Refinement of Cast Al and Its Alloys. III. The Influence of Hot Working on the Refined Cast Structure of Al and Al Alloys.** S. Terai, *Japan Institute of Metals, Journal,* v. 20, Oct. 1956, p. 536-540. (CMA)

The influence of hot working on the cast structure of aluminum alloys refined by titanium with or without boron additions was studied. Preheating of ingots caused the cast grain size to grow but larger refining additions reduced grain growth. This was true also in the rolled condition. 5 ref. (N3m, 3-18; Al)

65-N. (Book.) **Order-Disorder Phenomena.** E. W. Elock. 166 p. 1956, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $2.50.

Order-disorder of binary alloys and the relation of binary alloy ordering to other topics in solid-state physics. (N10b)

Physical Properties

36-P. Magnets: There's Untapped Strength in Pure Iron Powder. F. E. Jaumot, Jr., and A. E. Berkowitz. *Iron Age,* v. 178, Dec. 20, 1956, p. 88-89.

Theoretical considerations indicate compacted iron powder will make stronger field and lighter weight magnet. (P17, H general; SGA-n, Fe)

37-P. (Japanese.) **What Is a Permanent Magnet?** Yuki Shirakawa. *Metals,* v. 26, Dec. 1956, p. 906-910.

Characteristics of magnets; methods of expressing the characteristics of magnets; methods of enlarging the coercive force; effect of cooling in magnetic fields. Lists of JIS (Japan Industry Standards) on permanent magnets. 7 ref. (P16; SGA-n, 15-11)

38-P. (Japanese.) **Progress in Modern Permanent Magnets.** Yuji Tachikawa. *Metals,* v. 26, Dec. 1956, p. 911-917.

Fundamental concepts of permanent magnets; experimental methods. Theory of coercive force (strain theory, magnetization fluctuation theory, fine particle theory). Results of research on several permanent magnets alloys and steels and fine particle magnets. 47 ref. (P16; SGA-n)

39-P. Soft Magnetic Materials. *Electrical Manufacturing,* Jan. 1957, p. 66, 312-314.

Aluminum-iron alloys, vanadium-iron-cobalt alloy and irradiated materials are evaluated. (P16; SGA-n)

40-P. The Behaviour of Molybdenum on Cathodic Polarisation With Reference to the Effect of Anions on Its Hydrogen Overpotential. H. Khalifa and I. M. Issa. *Indian Chemical Society, Journal,* v. 33, Sept. 1956, p. 635-640. (CMA)

The behavior of molybdenum on cathodic polarization was compared with that of chromium to see if the anions influenced the Tafel-line slopes; therefore, the hydrogen overvoltage was studied using solutions of pure HCl, pure NaOH and mixtures of each of these with alkali phthalate, borate, phosphate and nitrate. Anions greatly influence the Tafel-line slopes when molybdenum is cathodically polarized, except for phosphate ions in acid solution. (P15; Mo)

41-P. Enthalpy and Specific Heat.. Critical Survey of Methods of Determination for Iron and Steel. J. R. Pattison. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 595-599.

Measurements of enthalpy and specific heat of a metal in the solid or liquid state; calculation of latent heat. Specific heat and enthalpy of iron. (P12r, 1-4; Fe)

42-P. Enthalpy of a 0.12% Carbon Steel. J. R. Pattison. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 600-601.

Thermal analysis of the steel at the temperatures of allotropic points. (P12r; CN)

43-P. Enthalpy of Pure Iron. J. R. Pattison. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 601-605.

Calorimetric method and its apparatus for enthalpy measurement. (P12r, 1-3; Fe)

44-P. Solubility and Diffusivity of Gold, Iron and Copper in Silicon. J. D. Struthers. *Journal of Applied Physics,* v. 27, Dec. 1956, p. 1560.

Solubility and diffusion constants determined by using radioactive isotopes. (P12e, N1; Si, *Au, Fe, Cu*)

45-P. Thermal Expansion Coefficients for Uranium Boride and Beta Uranium Silicide. Gunvor Beckman and Roland Kiessling. *Nature,* v. 178, Dec. 15, 1956, p. 1341.

Determination by X-ray powder methods and a high-temperature camera, mean values for the expansion coefficients between room temperature and 205° C. for different directions in the lattice are summarized. (P11g, M26r; U)

46-P. Differential Elastic Scattering of 14 MeV Neutrons in Lead, Mercury and Zinc. H. Nauta. *Nuclear Physics,* v. 2, Oct. 1956, p. 124-131.

Differential cross sections for the elastic scattering of 14 MeV neutrons from lead, mercury and zinc have been measured in a ring geometry using a biased detection with a spherical liquid scintillator. 9 ref. (P18j; Pb, Hg, Zn)

47-P. Resistivity Changes in Ag-Pd Alloys. W. H. Aarts and A. S. Houston McMillan. *South African Journal of Science,* v. 53, Nov. 1956, p. 88.

In measurements carried out on palladium and silver alloys it was found that the 50 at.% alloys behaved normally but that the 75% Ag, 25% Pd alloy, when plastically deformed, also showed a decrease in resistivity. (P15g; AG, Pd)

48-P. Reactions of Cerium and Lanthanum With Ceramic Oxides. G. R. Pulliam and E. S. Fitzsimmons. *U. S. Atomic Energy Commission. ISC-659,* July 1955, 59pp. (CMA)

The surface properties of cerium and lanthanum melted on refractory oxide plaques were studied by the sessile drop method and included surface tension, contact angles, work of adhesion and interfacial reactions. Data on the latter were obtained by metallographic and X-ray methods. Of the refractories studied (alumina, beryllia, thoria and zirconia), beryllia was best from a diffusion and interfacial reaction viewpoint but zirconia is considered feasible. 22 ref. (P13h; RM-h, Ce, La)

49-P. (English.) **Scattering of Slow Mu-Mesons in Copper.** A. I. Alikhanian and V. G. Kirillov-Ogriumov. *Academy of Sciences of the U. S. S. R. Physical Series. (Columbia Technical Translations),* v. 19, no. 6, p. 667-675.

In the momentum interval from 80 to 139 Mev/c there is an excess of cases of mu-meson scattering to angles with a projection greater than 15°. (P18n; Cu)

50-P. (English.) **Thermal Expansion Coefficient, Rigidity Modulus and Its Temperature Coefficient of the Alloys of Iron, Nickel, Cobalt and Chromium, and Relations of Super Invar to Stainless Invar and of Elinvar to Co-Elinvar.** Hakaru Masumoto, Hideo Saito, Tatsuo Kono and Yutaka Sugai. *Science Reports of the Research Institutes, Tohoku University,* v. 8, Dec. 1956, p. 471-483.

Influence of an addition of chromium on the thermal expansion, rigidity modulus and its temperature coefficient of the alloys of iron, nickel and cobalt. (P11g, 2-10; Fe, Ni, SGA-s)

51-P. (English.) **Thermodynamic Activities in Iron-Cobalt Solid Solutions.** Tsuneo Satow, Sukeji Kachi and Keizo Iwase. *Science Reports of the Research Institutes, Tohoku University,* v. 8, Dec. 1956, p. 502-510.

Procedure, errors and results of the experiments concerning alpha and gamma phase, superlattice formations of entropies and heat of formation. (P12q, P12s, N10a; Fe, Co)

52-P. (English.) **Effects of Additionals on the Magnetic Properties of $PbO-Fe_2O_3$ System.** Hiroshi Kojima. *Science Reports of the Research Institutes, Tohoku University,* v. 8, Dec. 1956, p. 540-546.

Experimental results of sintering temperature; effects of Fe_2O_3/PbO; effects of ZnO, CdO, SnO, MgO, NiO, CuO and CoO, Cr_2O_3, B_2O_3, GeU_2, SrO_2 and ZrO_2. Some effective additionals were found. (P16, 2-10; Pb, Fe)

53-P. (German.) **Electron Emission in the Case of Oxidation of Mechanically Polished Metal Surfaces.** J. Lohff. *Zeitschrift fur Physik,* v. 146, Oct. 1946, p. 436-446.

A series of chemically active metals emits streams of electrons after surface treatment with a steel brush, whose intensity is chiefly dependent on oxygen, not hydrogen, in the container. These intensities decrease at higher temperatures, the emissions increase to a maximum with time and then decrease. Results are contrary to the "Haftstellen Theory" in nonmetals. (P17d, L10e)

54-P. (Russian.) **Absolute Dynamic Method of Determining the True Specific Heat of Metals.** A. I. Lazarev, *Sb. rabot Leningr. in-ta tochnoy mechaniki i optiki,* No. 12, 1954, p. 32-45. From *Referativnyy Zhurnal Fizika,* No. 9, Sept. 1956, Abstract No. 25291.

Two new methods were devised for determining the specific heat of metals in the solid and liquid state. The metallic specimens are put into a massive metallic block and thermally isolated from the block and from each other. One of the specimens is supplied with a heater. The block is heated in a furnace and the power supplied to one specimen and the difference in temperatures between the block and the specimens and the temperature of the block are measured. In the absolute method both specimens are identical while in the comparative method, one of the specimens is made of standard metal, but the shape, surface and size of the specimens are identical. (P12r, 1-4)

Q Mechanical Properties and Tests

82-Q. Allowance for Stress Concentration in Design to Prevent Fatigue. Horace J. Grover. Paper from "International Conference on Fatigue of Metals". v. I. Institution of Mechanical Engineers. 9 p.

Evidence for effective stress-concentration factors was derived from laboratory tests on specimens with simple geometrical discontinuities under various load conditions. (Q7g, Q25k)

83-Q. An Analysis of the Effects of Shot-Peening Upon the Fatigue Strength of Hardened and Tempered Spring Steel. A. G. H. Coombs, F. Sherratt and J. A. Pope. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 10 p. + 4 plates.

Effects of shot velocity, energy and size on fatigue life. (Q23g, G23n; CN, SGA-b)

84-Q. The Basic Mechanism of Fatigue and Its Dependence on the Initial State of a Material. P. J. E. Frosyth. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 5 p. + 2 plates.

The microscopic changes or damage which precede the formation of fatigue cracks and the changes which occur in the small volume of material at the tip of the crack when propagating are illustrated in pure and alloyed aluminum. (Q23g, Q26q; Al)

85-Q. The Behaviour of Single Crystals of Iron Under Fatigue Loading. H. A. Lipsitt and G. T. Horne. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 9 p. + 2 plates.

The range of stresses which will cause fatigue failure in less than 2 x 10^7 cycles in single crystals of nominally pure iron tested in axial tension-compression is very narrow. Deformation characteristics are similar to those in static tension, except that cross slip is more prevalent in fatigue. (Q7; Fe, 1-4)

86-Q. Cumulative Damage Under Random Loading. A. M. Freudenthal. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 7 p.

Random fatigue testing machine; tests on 2024 and 7075 aluminum alloys. (Q7; Al)

87-Q. Cumulative Fatigue Damage. H. T. Corten and T. J. Dolan. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 14 p.

A phenomenological hypothesis of fatigue damage, visualized as the nucleation of submicroscopic voids which develop into cracks, is given in terms of the number of damage nuclei and the rate of damage propagation. (Q26q)

88-Q. Damping and Resonant Fatigue Behaviour of Materials. B. J. Lazan. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 14 p.

The general role of material damping in minimizing near-resonant fatigue stress is analyzed by developing criteria based on material properties and stress distribution for evaluating the resonant fatigue strength of parts. (Q23q, Q8k)

89-Q. The Distinction Between Initiation and Propagation of a Fatigue Crack. John A. Bennett. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 5 p. + 3 plates.

Distinction may be difficult to make when the cracks are small, and any nondestructive method for identifying cracks should be verified by metallographic examination of sections cut through the questionable markings. (Q26q)

90-Q. Distribution Functions for the Prediction of Fatigue Life and Fatigue Strength. A. M. Freudenthal and E. J. Gumbel. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 12 p.

Fatigue theories and scatter of fatigue strength and life; boundary conditions; distribution of fatigue life at constant stress amplitude and fatigue strength at constant number of cycles; fatigue life-fatigue strength relation. (Q23g)

91-Q. Effect of Fatigue Stresses on Creep and Recovery. A. J. Kennedy. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 9 p.

Creep of lead under static stress with superimposed fatigue stresses. Effect of a fatigue vibration on the recovery properties of work hardened metals. (Q23d, Q23g, Pb)

92-Q. Effect of Large Hydrostatic Pressures on the Torsional Fatigue Strength of an Alloy Steel. B. Crossland. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 14 p.

Fluid pressure has no effect on the stress-strain curve except to increase the strain to failure by about 80% at 20 tons per sq.in. pressure. (Q23g, 3-24; AY)

93-Q. The Effect of Mean Stress on the Fatigue of Aluminium Alloys. A. R. Woodward, K. W. Gunn and G. Forrest. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 16 p.

Fatigue properties of seven alloys; stress-mean stress diagrams; application of several theories to behavior or the alloys tested. (Q23g, 3-16; Al)

94-Q. The Effect of Mean Stress on the Push-Pull Fatigue Properties of an Alloy Steel. H. C. O'Connor and J. L. M. Morrison. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 10 p.

The limiting safe range of stress was investigated for mean stresses varying from 30 tons per sq.in. compression to 37½ tons per sq.in. tension. There is a linear relation between the safe range of stress and the mean stress for all ranges of stress in which the lower static yield is not exceeded. (Q23g, 3-16; AY)

95-Q. Effect of Unintentional Stress Raisers on the Fatigue Strength of Structural Components. E. C. Hartmann. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 8 p.

The final effect of many unintentional discontinuities on the fatigue strength of finished parts is found to be entirely negligible. (Q23g)

96-Q. Effect of Variable Load and Cumulative Damage on Fatigue in Vehicle and Airplane Structures: The Fatigue Strength of Vehicle and Aircraft Components. E. Gassner. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 8 p.

Results of practical-vehicle-running and laboratory-program tests compared. (Q23g, Q7, S21)

97-Q. Experiments Relating to the Basic Mechanism of Fatigue. N. Thompson. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 6 p. + 4 plates.

Stages in the development of a fatigue crack in a single crystal of copper and in polycrystalline nickel. (Q26q; Cu, Ni)

98-Q. Failure of Metals Under Cyclic Strain. W. A. Wood. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 6 p.

An interpretation of the fatigue property is based on study of the structural changes peculiar to fatigue. (Q23g)

99-Q. The Fatigue Behaviour of Iron With Intergranular Weakness. H. R. Tipler and P. G. Forrest. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 5 p.

Tests reveal an unusual type of fatigue failure in iron having exceptionally weak grain boundaries. (Q23g, M27f; Fe)

100-Q. Fatigue Endurance of Large Parts With Electro-Slag Welds. E. P. Unksov. Paper from "International Conference on Fatigue of Metals". v. III. The Institution of Mechanical Engineers. 8 p. + 4 plates.

Fatigue endurance of welded joint without heat treatment and with reinforcement left intact is lower than that of unwelded samples. Heat treatment increased endurance by 30-35%. Mechanical treatment with no reinforcement was extremely favorable. (Q23g; 7-1)

101-Q. Fatigue of Curved Surfaces in Contact Under Repeated Load Cycles. N. G. Kennedy. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 10 p. + 4 plates.

Tests suggest that damage to the surface of curved elastic pairs in contact under cyclic loading stems from surface conditions at the boundary of the area of contact. (Q7)

102-Q. Fatigue of Metals Under Contact Friction. I. A. Oding and V. S. Ivanova. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 8 p.

Reduction in fatigue limit in conditions of contact friction can be explained by the process of electric erosion that proceeds under the action of a thermo-electric current produced as a result of friction, and which pulsates in magnitude because of a variation in the resistance of the contact. (Q23g, Q23f)

103-Q. Fatigue of Plain Bearings. W. E. Duckworth and G. H. Walter. Paper from "International Conference on Fatigue of Metals". v. III. The Institution of Mechanical Engineers. 10 p. + 2 plates.

Mechanism of fatigue, determination of fatigue strength, factors influencing fatigue strength, relation between thickness and strength of linings, stress analysis, influence of backing materials. (Q23g; SGA-c)

104-Q. Fatigue of Wrought High-Tensile Alloy Steels. P. H. Frith. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 41 p.

Includes 287 fatigue results for various types or combinations of reversed stress. (Q23g; AY)

105-Q. The Fatigue Problem in Welded Construction. R. Weck. Paper from "International Conference on Fatigue of Metals". v. III. The Institution of Mechanical Engineers. 11 p. + 4 plates.

Some general considerations, fatigue in welds and joints, metallurgical aspects and welding processes, residual stress, service experience and failures. (Q23g, K1; 7-1)

106-Q. Fatigue Properties of Some Nonferrous Metals Excluding Light Alloys. J. McKeown. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 9 p.

Lead and lead alloys, copper and its alloys, metals for sleeve bearings, coating metals. (Q23g; SGA-c, Pb, Cu)

107-Q. Fatigue Properties of Steel at High Temperatures. F. Wever. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 7 p. + 2 plates.

Fatigue strength and mean stress, stress fracture times for static and alternating loading, notch effect and surface hardening, metallographical investigations. (Q23g, 2-12; ST)

108-Q. Fatigue. Residual Stresses and Surface Cold Working. R. L. Mattson. Paper from "International Conference on Fatigue of Metals". v. III. The Institution of Mechanical Engineers. 13 p. + 2 plates.

Experimental data illustrate the importance of these problems. (Q23g, Q25h, 3-18)

109-Q. Fatigue Strength in Shear of an Alloy Steel With Particular Reference to the Effect of Mean Stress and Directional Properties. W. T. Chordorowski. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 12 p. + 2 plates.

Tests under torsional fatigue stresses on longitudinal oblique, and transverse specimens. (Q23g, 3-16, 3-22; AY)

110-Q. Fatigue Testing of Compression-type Coil Springs. R. C. Coates and J. A. Pope. Paper from "International Conference on Fatigue of Metals". v. III. The Institution of Mechanical Engineers. 15 p.

Spring fatigue testing machines. Effects of shot-peening, scragging, scragging and peening and mean stress. (Q7b; SGA-b)

111-Q. Fatigue Tests on Seamless Mild-Steel Pipe Bends. P. H. R. Lane. Paper from "International Conference on Fatigue of Metals". v. III. The Institution of Mechanical Engineers. 10 p. + 2 plates.

Specimens were subjected to pulsating internal pressure and to alternating external loading in the plane of the bend. (Q7; CN, 4-10)

112-Q. Further Results of Fatigue Under Triaxial Stress. J. S. C. Parry. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 8 p.

The low critical shear stress previously found for the fatigue limit for unprotected cylinders subjected to repeated internal pressures appears little affected by wide variation of tri-axial tensile stress or fluid pressure. Strength can be raised by honing the bore after heat treatment or by protecting the bore from the fluid by a thin film or rubber. (Q7e)

113-Q. The Growth of Fatigue Cracks Under Plastic Torsion. F. A. McClintock. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 7 p. + 2 plates.

Theoretical analysis and experiments with an aluminum alloy. (Q7, Q26q; Al)

114-Q. Hardness Changes During Fatigue Tests on Copper. R. B. Davies, J. Y. Mann and D. S. Kemsley. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 8 p.

Progressive hardness changes during fatigue, hardness traverses along fractured specimens, metallographic examination. (Q23a, Q7; Cu)

115-Q. Hydrogen Occlusion and Its Effect on the Fatigue Properties of Plain Carbon Spring Steels. J. S. Jackson. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 8 p.

Conditions of steel which tend to lower the ductility are more prone to the damaging effects of hydrogen occlusion. Occluded hydrogen has very little effect on the fatigue limit of cold-worked spring steels but can cause a marked falling off in resistance to fatigue at stress ranges above the fatigue limit. (Q23g, CN, H, SGA-b)

116-Q. The Influence of Frequency of Vibration on the Endurance Limit of Ferrous Alloys at Speeds up to 150,000 Cycles Per Minute Using a Pneumatic Resonance System. T. W. Lomas, J. O. Ward, J. R. Rait and E. W. Colbeck. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 13 p.

There is a definite influence of frequency on the endurance limit of a wide range of materials when tested in resonance. The pneumatic technique appears to be very sensitive to notches. (Q23g; Fe, ST)

117-Q. Influence of Plastic Deformation on Notch Sensitivity in Fatigue. P. G. Forrest. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 15 p.

The dynamic plastic strain per cycle varies during the course of a fatigue test for most of the materials investigated. Measurements afford no evidence that failure by fatigue is inseparably associated with plastic deformation. (Q7, 3-18)

118-Q. Influence of Residual Stresses on the Fatigue Limit. H. Sigwart. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 12 p.

Nature of residual stresses including stresses due to local plastic deformations, unequal heating and unequal stress distribution. Some examples of residual stresses. Effect of stresses on fatigue properties. (Q23g, 3-16)

119-Q. The Influence of Some Surface Factors on the Torsional Fatigue Strength of Spring Steels. J. F. Watkinson. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 16 p. + 4 plates.

Shot peening improves fatigue strength of quenched and tempered spring steel in both the polished and the heat treated conditions. Decarburization reduces the residual stresses present after peening and markedly reduces the fatigue strength of the shot-peened specimens. (Q23g, G23n; CN)

120-Q. The Influence of Temperature on the Fatigue of Metals. N. P. Allen and P. G. Forrest. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 16 p. + 3 plates.

Fatigue of copper, mild steel and some technical creep-resisting alloys; fatigue under fluctuating stresses at high temperature; correlation of creep strength and fatigue strength; influence of metallographic structure and corrosion. (Q23g, Q23f, 2-11; Cu, CN)

121-Q. Interpretation of Fatigue Strengths for Combined Stresses. Joseph Marin. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 13 p.

Development of theory for predicting fatigue strength of materials under combined states of stress. Comparisons with test data. (Q7f)

122-Q. Mechanical Aspect of Size Effect on Fatigue of Metals. G. V. Uzhik. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 6 p.

Discontinuity of the material itself is not likely to decisively affect the fatigue strength under a size increase. (Q23g, 3-23)

123-Q. Metallographic Observations on the Fatigue of Steels. H. Hempel. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 7 p. + 15 plates.

Formation of slip markings and propagation of cracks at room temperature; formation of twin crystals at low temperature. (Q23g, Q26p, M27e; ST)

124-Q. On the Endurance of Cast Iron and Steel Under Repeated Loading of Varying Amplitude. S. W. Serensen. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 9 p.

Fatigue curves were statistically treated, taking into account the large scattering of test data, and correlation equations between the stress amplitude and number of cycles were determined. (Q7; ST, CI)

125-Q. The Influence of Fillet Radius on the Fatigue Strengths of Large Steel Shafts. S. F. Dorey and G. P. Smedley. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 12 p. + 2 plates.

Results of full-scale torsional fatigue tests. (Q7, ST)

126-Q. The Reactions of High-Strength Aluminium Alloys to Alternating Stresses. R. F. Hanstock. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 9 p. + 2 plates.

The fatigue process, dynamic properties of aluminum alloys, nature of the changes in hysteresis induced by prolonged cyclic stresses, differences between the effects of thermal treatment and cyclic stressing, precipitation produced by cyclic stressing. (Q7e; Al)

127-Q. Relation of Inclusions to the Fatigue Properties of High-Strength Steels. F. B. Stulen, H. N. Cummings and W. C. Schulte. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 8 p.

Fatigue life and strength of high-strength steels, heat treated to a given ultimate tensile strength, depend largely on the size and location of inclusions. (Q23g, 9-19; AY)

128-Q. Short Endurance Fatigue. A. C. Low. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 8 p.

For the five widely differing materials tested, with tensile strengths varying from 21 to 57 tons per sq. in., but all with good ductility, fatigue life in reversed bending was found to depend solely on the degree of strain, for maximum fiber strains between $\pm 0.4\%$ and $\pm 5\%$. (Q7b)

129-Q. Some Preliminary Fatigue Results on a Steel of up to 800 V. P. N. Hardness Using Notched and Unnotched Specimens. J. E. Russell and D. V. Walker. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 5 p.

There is no confirmation of the theory that low fatigue ratios for very high tensile steel are due to lower tempering temperature. No significant improvement in fatigue properties is noted for carbon contents above 0.5%. Tendency of notch susceptibility to fall with increasing hardness above Vickers 400 is confirmed. (Q7; ST)

130-Q. Strength Reduction Factors for Small Quenching Cracks and for Decarburized Steel. J. A. Pope and C. W. Barson. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 8 p. + 2 plates.

Heavy decarburization is more detrimental to the fatigue strength of the silicon-manganese steel tested than the small quenching cracks induced. Overstrain has no beneficial effect upon the quenching cracks. (Q23g, J4a; ST, 9-22)

131-Q. Stress Concentration in Relation to Fatigue. H. L. Cox. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 12 p. + 2 plates.

The present state of knowledge of stress concentration in relation to needs of designer. (Q23g, Q25k)

132-Q. Studies in the Formation and Propagation of Cracks in Fatigue Specimens. N. E. Frost and C. E. Phillips. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 9 p. + 4 plates.

The existence and formation of nonpropagating cracks in notched specimens subject to fatigue leading; conditions necessary to form nonpropagating cracks and their effects on notch sensitivity; strength reduction factors of cracks; crack propagation. (Q26q, Q7a)

133-Q. A Study of the Strain Cycling and Fatigue Behaviour of a Cold-Worked Metal. L. F. Coffin and J. H. Read. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 12 p.

The strain softening of AISI 347 stainless steel is examined as a function of degree of prior cold work and temperature.
(Q23g, 3-18, 2-11; SS)

134-Q. Theory for Combined Bending and Torsion Fatigue With Data for SAE 4340 Steel. W. N. Findley, J. J. Coleman and B. C. Hanley. Paper from "International Conference on Fatigue of Metals". v. I. The Institution of Mechanical Engineers. 10 p.

Mathematical formulation of the effect of a normal stress acting on the critical shear plane. Comparisons with experimental data.
(Q7b; AY)

135-Q. Very High-Speed Fatigue Testing. A. R. Wade and P. Grootehuis. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 11 p.

Choice of type of high-speed machine, calculation of stress, fatigue tests. (Q7)

136-Q. (English.) **Hardness of Spherodial Graphite Cast Iron Containing Various Amouts of Ferrite.** Takaji Kusakawa and Toyoharu Kasai. *Castings Research Laboratory, Report, Waseda University,* 1956, no. 7, p. 7-12.

Rockwell and Brinell hardness is first increased, then decreased, by addition of silicon, and is rapidly increased by magnesium treatment. Hardness of ferrite phase is higher than that in flake graphite iron.
(Q23a, 2-10; CI)

137-Q. Physical Properties of Zirconium. A. D. Schwope. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 35-37. (CMA)

The thermal creep, fatigue, impact, galling and strength properties of zirconium surveyed. Concluded that thermal stress is 1/6th that generated in stainless steel, that cold working increases the creep resistance, that zirconium is more sensitive to strain rate than iron, and that working and α annealing should be used when the metal has been heated in the β region. Solid lubricants reduce friction more effectively than liquids. (Q23, 3-18; Zr)

138-Q. Australian Work on Aircraft Fatigue and Life Evaluation. F. H. Hooke and P. S. Langford. *Aircraft Engineering,* v. 28, Dec. 1956, p. 408-414.

Cases of failure due to fatigue of metal parts. Past, present and future research in aircraft structural fatigue discussed. 15 ref.
(Q23g, T24)

139-Q. Creep Deflexion of Magnesium Alloy Struts. A. E. Johnson, V. D. Mathur and J. Henderson. *Aircraft Engineering,* v. 28, Dec. 1956, p. 419-425.

Report on research into properties of magnesium alloy struts at room temperature. Object was to predict the creep deflection of magnesium alloy struts from tensile creep data.
(Q23e; Mg)

140-Q. Adhesive-Bonded Joints Tested by Ultrasonics. E. L. Gray. *American Machinist,* v. 100, no. 27, Dec. 17, 1956, p. 122-125.

Mechanical-impedance methods of testing for inspectiing both metal-to-metal and sandwich bonded panels. Voids and in some cases substandard bonds can be detected. (Q10c)

141-Q. Buckling of Tapered Plates in Compression. Bertram Klein. *Aircraft Engineering,* v. 28, Dec. 1956, p. 427-430.

General equation has been derived for calculating the buckling load of tapered plates that have an axis of symmetry and are symmetrically loaded about this axis. (Q28, 4-3)

142-Q. Effect of Cerium on the Mechanical Properties of a Cast Titanium Alloy. H. W. Antes and R. E. Edelman. *Foundry,* v. 85, Jan. 1957, p. 116-119. (CMA)

The effect of cerium additions on cast grain size and mechanical properties of Ti-6Al-4V was studied; two heat treatments were used. Cerium up to 0.42% was added and is found to decrease strength and ductility, due to a cerium-rich phase at the grain boundaries; grain size is reduced but no benefit from the reduction was apparent. Impact fractures were found to vary in appearance according to the amount of cerium added. (Q general, 2-10; Ti, *Ce*)

143-Q. The Effects of Internal Oxidation on the Tensile Properties of Some Silver Alloys at Room and Elevated Temperatures. E. Gregory and G. C. Smith. *Institute of Metals, Journal,* v. 85, No. 3, Nov. 1956, p. 81-87.

Conditions affecting the production of nonmetallic phases by internal oxidation of silver alloys containing silicon or aluminum investigated. A very marked inhibition of grain growth and recrystallization obtained. Strength was dependent on the degree of dispersion of the oxide, the greatest improvement in specimens containing the finest dispersion. 13 ref. (Q23n, R2s; Ag)

144-Q. The Hardness of Manganese and Some Manganese-Rich Alloys. H. O'Neill and Vernon Griffiths. *Institute of Metals, Journal,* v. 85, No. 3, Nov. 1956, p. 105-108.

Diamond-pyramid hardness tests on electrolytic manganese and some of its dilute alloys. Hardness values of some quenched gamma alloys of manganese with copper and nickel, after various reheating treatments.
(Q23a; Mn)

145-Q. A Proposed Method for Calculating Residual Stresses in Iron Rolls. Charles F. Peck, Jr. *Iron and Steel Engineer,* v. 33, No. 12, Dec. 1956, p. 121-124.

The method of computation of radial stress and longitudinal stress as residual stress in iron rolls. Data for ratio of tensile to compressive stress versus diameter of roll.
(Q25h, W22, 17-7; CI)

146-Q. The Craze-Cracking of Metals. L. Northcott and H. G. Baron. *Iron and Steel Institute, Journal,* v. 184, Dec. 1956, p. 385-409.

This type of failure occurs when a surface is repeatedly heated and cooled. Previous work and present experimental methods and the results. 40 ref. (Q26q, 2-11)

147-Q. Statistical Investigation of the Fatigue Life of Deep-Groove Ball Bearings. J. Lieblein and M. Zelen. *Journal of Research, National Bureau of Standards,* v. 57, Nov. 1956, p. 273-316.

Manufacturers' pooled test data, compiled by American Standards Association and analyzed by the National Bureau of Standards. Purpose is to set up uniform ball-bearing application formulas. 21 ref.
(Q23g, S12, T7d)

148-Q. Fundamentals of Wear. *Lubrication,* v. 42, Dec. 1956, p. 149-160.

Various phenomena associated with the sliding of bearing surfaces: basic processes involved and contributing effects of surface films: typical lubricant performance characteristics. 47 ref.
(Q23f; SGA-c, NM-h)

149-Q. Mechanism of "Free" Rolling Friction. D. Tabor. *Lubrication Engineering,* v. 12, Nov.-Dec. 1956, p. 379-386.

It is suggested that the major source of "free" rolling friction is elastic hysteresis in the solids themselves. (Q9p)

150-Q. Concentration Effects of Cutting Oil Additives in Performance Evaluation. A. Dorinson. *Lubrication Engineering,* v. 12, Nov.-Dec. 1956, p. 387-391.

Hypothesis suggests that behavior for a particular cutting oil will depend on the relation between wear by metal contact of chip and tool, and wear by chemical reaction of the tool material with the additive. 10 ref. (Q9n, G17; NM-h)

151-Q. New Leaded Steels Reduce Machining of Large Gears. C. R. Funk. *Materials and Methods,* v. 44, no. 6, Dec. 1956, p. 94-95.

New steels, called Hi-Qua-Led, are now in production. Tensile, bend and impact properties remain the same, but the lubricating action of lead permits faster speeds and deeper cuts in machining.
(Q23, G17k; ST, *Pb*)

152-Q. Why Bolts Fail. Fred J. Poss. *Steel,* v. 139, Dec. 3, 1956, p. 125-126.

Bending stresses caused by deviation from perpendicular of nut and bolt bearing surfaces may be most common cause of failure.
(Q25q, T7f)

153-Q. What Copper Alloy Forgings Can Do. Arthur I. Heim. *Steel,* v. 139, Dec. 31, 1956, p. 58-60.

Details properties and expected tolerances of hot pressed copper alloy forgings. (Q general; Cu, 4-1)

154-Q. Further Studies on the Effect of Microstructure on Notch Tough-

ness and Fracture Morphology. J. C. Danko, J. H. Gross and R. D. Stout. *Welding Research,* v. 21, Dec. 1956, p. 604s-609s.

Influence of some types of discontinuous phases in a nominally constant ferrite matrix on the notch toughness of the aggregate. 5 ref. (Q23r, Q26, 3-21; 7-1)

155-Q. Triaxial Tension Testing and the Brittle Fracture Strength of Metals. N. Bredzs and H. Schwartzbart. *Welding Research,* v. 21, Dec. 1956, p. 610s-615s.

Data on the effect of joint thickness on tensile strength of mild steel and drill rod brazed with silver and copper. 6 ref. (Q27, Q23n; CN, 7-2)

156-Q. Fatigue of Welded Joints Committee. LaMotte Grover. *Welding Research Council Yearbook,* 1956, p. 32-33.

Studies in progress at the University of Illinois on evaluating and improving the behavior of welded members and connections which are subjected to repeated loads. (Q23g; 7-1)

157-Q. Properties of Hot-Rolled Steel Plates: Influence of Silicon and Aluminum as Deoxidizers. *Iron and Coal Trades Review,* v. 158, Dec. 14, 1956, p. 1450.

Additions of silicon and aluminum to steels of different manganese content were studied to determine the influence of these two elements on the notched-bar properties of hot rolled steel.
(Q23; ST, 4-3, *Si, Al,* AD-r)

158-Q. Tensile Strength of Whiskers. S. S. Brenner. *Journal of Applied Physics,* v. 27, Dec. 1956, p. 1484-1491.

Tensile tests performed on whiskers of iron, copper and silver 1.2 to 15 microns in diameter. The strongest whiskers, which were less than 4 microns in diameter, exhibited resolved elastic shear strengths of from 2 to 6% of their shear moduli.
(Q23n; Fe, Cu, Ag, 14-11)

159-Q. Low-Temperature Brittleness. Charles S. Barrett. *Metal Progress,* v. 70, Dec. 1956, p. 68-72.

Interrelation between brittle fracture of ship plate and many of the physical properties which are determined by crystalline perfection. (Q26s, 2-13, M2bs; ST, 4-3)

160-Q. Die Steel Useful for Ultra High-Strength Structural Requirements. John C. Hamaker, Jr. *Metal Progress,* v. 70, Dec. 1956, p. 93-96B.

Strength, toughness, ductility and thermal stability of a 5% chromium die steel are superior to those of any ultra high-strength structural alloy proposed for aircraft operation in the temperature range of −100 to 1000° F. (Q23; TS, SGB-s)

161-Q. Recent Studies on Ductile Molybdenum. Julius J. Harwood. *Metal Progress,* v. 70, Dec. 1956, p. 97-101.

Deoxidation practice and alloying elements improve ductility by converting the precipitates (oxides, nitrides and carbides) into innocuous forms, by affecting the solubility relationships of the interstitial impurities, and by altering the kinetics of the aging process.
(Q23p, C25; Mo, 9-1)

162-Q. Fe-Al-Mo Alloys for High-Temperature Use. J. F. Nachman and W. J. Buehler. *Metal Progress,* v. 70, Dec. 1956, p. 107-110.

The light weight, excellent oxidation resistance and high strength at elevated temperatures of iron-aluminum-molybdenum alloys indicate their potential utility as replacements for iron-chromium and iron-chromium-nickel alloys.
(Q23n, 2-12; SGA-h, Fe, *Al, Mo*)

163-Q. Forgeability. Albert Portevin. *Metal Progress,* v. 70, Dec. 1956, p. 120-123.

Comments on forgeability and metal forming. (Q23q)

164-Q. Deformation Twinning in Materials of the A4 (Diamond) Crystal Structure. A. T. Churchman. *Proceedings of the Royal Society, Series A.,* v. 238, no. 1213, Dec. 18, 1956, p. 194-203.

Deformation twins have been observed on (111) and (123) planes in silicon, germanium, indium antimonide and gallium antimonide. 13 ref. (Q24b; Si, Ge, In, Ga)

165-Q. A Three-Dimensional Photoelastic Study of Contact Stresses in the Head of a Model of a Railroad Rail. M. M. Frocht. *Proceedings of the Society for Experimental Stress Analysis,* v. XIV. No. 1. p. 1-12.

Using the shear difference and the stress-freezing processes, principal stresses and maximum shears were determined in the transverse section of the rail under the center of the wheel. (Q28k; 4-7)

166-Q. Modified Theories of Fatigue Failure Under Combined Stress. W. N. Findley and P. N. Mathur. *Proceedings of the Society for Experimental Stress Analysis,* v. XIV. No. 1. p. 35-46.

Several proposed theories were modified to account for anisotropy and state of stress, and were examined in the light of existing data. (Q23g, 3-16, 3-21; 10-1)

167-Q. Stress Concentration Factors for Circular Fillets in Stepped Wall Cylinders Subject to Axial Tension. L. H. N. Lee and C. S. Ades. *Proceedings of the Society for Experimental Stress Analysis,* v. XIV. No. 1. p. 99-108.

Plastic cylinders were cast, cured, machined, stressed and sliced and slices were studied photoelastically. Hysol 6020 epoxide resin was found to be very promising. (Q25k; NM-d)

168-Q. The Study of the Propagation of Stress Waves by Photoelasticity. J. C. Feder, R. A. Gibbons, J. T. Gilbert and E. L. Offenbacher. *Proceedings of the Society for Experimental Stress Analysis,* v. XIV. No. 1. p. 109-122.

Wave propagation was followed with a high-speed framing camera and initiation of the stress waves by ballistic methods which produce high rates of loading. (Q21f)

169-Q. Mechanism of Fatigue. W. A. Wood. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 1-19.

Observations of fatigue deformation were interpreted as proceeding from fine slip as opposed to coarse slip and that pure fatigue may impose considerable plastic strain without progressive strain hardening. Tests on copper in alternating torsion showed that a total of nonhardening plastic strain could be imposed in fatigue that would be impractical in static deformation. 18 ref. (Q23f)

170-Q. The Mechanism of Fatigue in Aluminum and Aluminum Alloys. P. J. E. Forsyth. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 20-42.

Fatigue behavior was examined in superpurity aluminum, Al 4% copper alloy, Al 10% Zn and Al 7.5% Zn 2.5% Mg alloys. Recrystallization and aging was produced under fatigue stresses at nominally room temperature and occurred mainly in localized regions. 25 ref. (Q23f, N5f, N7a; Al)

171-Q. Experiments Relating to the Origin of Fatigue Cracks. N. Thompson. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 43-61.

Summary of results of investigations of copper and of aluminum on the basic mechanism of fatigue. Similarities in crack formation and crack propagation in the two metals. 8 ref. (Q7, Q26q)

172-Q. On the Effects Preceding Fatigue Failure of High-Strength Aluminum Alloys. R. F. Hanstock. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 62-82.

Resonance method of testing was employed. Variation of hysteresis with stress, critical stress and comparison of the effects of temperature and cyclic stress are discussed. 6 ref. (Q7; Al)

173-Q. Performance of Steel Under Repeated Loading. M. Hempel. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 83-103.

Results of investigations of deformation phenomena under cyclic stressing, fatigue strength of heat resisting steels at elevated temperatures in the range of 500-650° C., and effect of surface finish on the fatigue strength. 31 ref.
(Q23f, 2-12; SS, SGA-h)

174-Q. Fatigue Cracks as Stress Raisers and Their Response to Cyclic Loading. C. E. Phillips. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 104-125.

Observations of crack growth of unnotched and V-notched specimens of a mild steel, a heat treated nickel-chromium steel, and a 4% copper-aluminum alloy. 13 ref.
(Q26q; CN, AY, Al)

175-Q. Scatter of Fatigue Life and Fatigue Strength in Aircraft Structural Materials and Parts. W. Weibull. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 126-145.

Fatigue properties are described by S-N curves. Procedure for converting life distribution into strength distribution is discussed. 7 ref. (Q23f, Q7g, T24a)

176-Q. Accumulation of Fatigue Damage. A. M. Freudenthal and R. A. Heller. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 146-177.

Tape-programmed, random-load, rotating-beam fatigue testing machine is described. Results are correlated from random testing machines with constant amplitude testing machines. Results of random fatigue tests on 2024 and 7075 aluminum alloys are tabulated. 14 ref. (Q7c, X29; Al)

177-Q. Performance Fatigue Testing With Respect to Aircraft Design. E. Gassner. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 178-206.

Survey of fatigue testing in the German Aeronautical Research Institute, 1938-1945, and in the Laboratory for Performance Testing since the war, including wing load distributions, and service performance tests. 8 ref. (Q7g, T24a)

178-Q. Structural Fatigue Research and Its Relation to Design. P. D. Brooks. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 207-232.

Sequential steps in handling major fatigue requirements on complete design projects as applied to two typical aircraft, namely, medium-range transport, and long-range interceptor. 11 ref. (Q23g, 17-1, T24a)

179-Q. The Elements of a Helicopter Fatigue Substantiation Program. H. T. Jensen. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 233-254.

Basic facilities used in the test program are strain-gage flight test aircraft, tie down test aircraft, fatigue laboratory and the rotor-whirl stand. 4 ref. (Q7g, T24a)

180-Q. The Relationship Between Load Spectra and Fatigue Life. Bo Lundberg and Sigge Eggwertz. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 255-278.

Applications of the linear cumulative damage theory in conjunction with the straightline load spectrum and the adopted S-N relation in evaluation of conventional fatigue results can also be used in the evaluation of program test results. 24 ref. (Q7)

181-Q. Fatigue Testing in Relation to Transport Aircraft. R. J. Atkinson. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 279-294.

Examples of fatigue data on which design might be based, fatigue loading actions, and a scheme of testing geared to design and early production stages are discussed. 9 ref. (Q7g, T24a)

182-Q. Fatigue Engineering in Aircraft. Paul Kuhn. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 295-316.

A review of design problems involving fatigue under constant-amplitude loading and under variable-amplitude loading. 26 ref. (Q7d, Q7e, T24a)

183-Q. Some Remarks on the French Approach to the Problem of Fatigue. J. Cornillon. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 317-322.

General outline of methods employed including evaluation by cumulative damage theory and fatigue tests. 9 ref. (Q7)

184-Q. Aspects of Fatigue Design of Aircraft Structures. F. Turner. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 323-346.

Statistical approach is emphasized in design problems relative to fatigue and static failure. 17 ref. (Q7q, T24a)

185-Q. The Extent of the Fatigue Problem in Aircraft Design. H. Giddings. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 347-375.

Review of types of fatigue loading actions, strength and design of aircraft components, and effect of operating, inspection and maintenance procedures on fatigue life. (Q23f, T24a, 17-1)

186-Q. Practical Aspects of Fatigue in Aircraft Structures. R. L. Schliecher. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 376-426.

Unit and component fatigue tests, case histories, and an outline of good design practices. 12 ref. (Q7, T24a, 17-1)

187-Q. Aircraft Structural Fatigue Research in Australia. W. W. Johnstone and A. O. Payne. Paper from "Fatigue in Aircraft Structures". Academic Press, p. 427-448.

Review of fatigue research by the Structures Division of the Aeronautical Research Laboratories and summary of present status. 47 ref. (Q23f, T24a)

188-Q. (English.) **Improvement of Copper Alloy Spring. Pt. I. Effect of Various Third Elements Added to Plain 60/40 Brass.** Masayuki Kawasaki and Osamu Izumi. *Science Reports of the Research Institutes, Tohoku University,* v. 8, Dec. 1956, p. 484-492.

Iron, aluminum, manganese, nickel, cadmium and tin were added, and the alloys of copper-manganese-nickel and copper-iron series were also examined. (Q general, 2-10; Cu, SGA-b)

189-Q. (English.) **Improvement of Copper Alloy Springs. Pt. II. 60/40 Brass Series Containing Iron, Manganese and Tin.** Osamu Izumi and Masayuki Kawasaki. *Science Reports of the Research Institutes, Tohoku University,* v. 8, Dec. 1956, p. 493-501.

Manganese and tin proved to be the most favorable elements. (Q general, 2-10; Cu, *Fe, Mn, Sn,* SGA-b)

190-Q. (Japanese.) **On the Hot Hardness of Heat Resistant Titanium-Base Alloy.** T. Araki and J. Isono. *Japan Institute of Metals. Journal,* v. 20, Oct. 1956, p. 547-550. (CMA)

Titanium-base alloys were tested for heat resistance at high vacuum and temperatures up to 700° C. by measuring hardness. Hot hardness is found to increase with the amount of aluminum. Great hardness occurs in some alloys water-quenched from 900° C., due to tempering at 500° C.; such alloys contain at least 6% Al and 4% Mo and/or Cr. The latter go into the β phase during tempering. (Q23a, 2-12, 2-10; Ti)

191-Q. (Japanese.) **Improvement of Heat Resistance of Aluminum Alloys by Addition of Zirconium II.** Y. Mishima and N. Takahashi. *Light Metals,* v. 11, no. 21, 1956, p. 64-67. (CMA)

About 0.5% zirconium is effective in improving the heat resistance of aluminum alloy. Studies were conducted with six aluminum alloys, cold rolled to sheet, annealed and quenched. Tensile and hardness data are tabulated. (Q general, 2-12; Al, *Zr*)

192-Q. (Japanese.) **Theory of Plastic Deformation and Maximum Shearing Stress of Aluminum.** Koiti Saito. *Nippon Kikai Gakai,* v. 22, no. 123, Nov. 1956, p. 821-827.

Theory of plasticity based on the maximum shearing stress in the triaxial deformations of metals is established, using the experimental results as to the work hardening properties by pure shearing. Comparison of experimental results. 7 ref. (Q24; Al)

193-Q. (Japanese.) **Effects of Section Size on Static Tensile Properties of Mild Steel Bars.** Tadasi Isibasi. *Nippon Kikai Gakai,* v. 22, no. 123, Nov. 1956, p. 827-832.

Stress and strain in a round bar were analyzed by using the distribution of the axial stress over the cross-section of the bar. Reasons for unevenness of stress distribution over the cross-sections of streched specimens. Fundamental calculation of stress beyond the yield point. (Q27k; CN)

194-Q. (Japanese.) **Effect of the Stepwise Change of Stress on Creep of Carbon Steel at High Temperature.** Toshio Mishihara, Kichinosuke Tanaka and Kiyotsugu Oj. *Nippon Kikai Gakai,* v. 22, no. 123, Nov. 1956, p. 832-838.

Creep behavior of 0.14% carbon steel at 450° C. Apparatus for experiments; results. 10 ref. (Q23d, 1-3; CN)

195-Q. (Japanese.) **Researches on Titanium Fasteners—I. Photo-Elastic Determination of Stress Concentration Factors for the Unified Screw Thread.** I. Hiraki, S. Shimamura and Y. Kanae. *Tokyo. Government Mechanical Laboratory. Journal,* v. 10, Nov. 1956, p. 213-219.

The photo-elastic method was applied in the determination of stress concentration factors for the Unified Screw Thread of titanium fasteners. Four cases were considered: titanium bolt with titanium nut; titanium bolt with aluminum nut; load concentrated at a turn of the thread helix; and load distributed along the thread helix. The test used is considered more suitable than other tests. (Q25k, 1-4, T7; Ti)

196-Q. (Russian.) **Resistance to Deformation of Commercial Titanium.** L. N. Sokolov, V. I. Zaleskiy and V. P. Yelyutin. *Sb. Mosk, in-ta stali,* no. 33, 1955, p. 143-153. *Referativnyy Zhurnal Fizika,* no. 9, Sept. 1956, Abstract No. 25777.

The resistance to deformation of commercial titanium was determined by tensile methods (in the interval 20-800°) and deposition (at 400-800°). The speed of deformation during tension and deposition is 1.7 mm/per min. At room temperature commercial titanium has a strong resistance to deformation. At temperatures below 700° and small degrees of deformation (up to 10%) strengthening of titanium occurs. A considerable increase of deformation does not produce further strengthening. Over 700° titanium has a low resistance to deformation. The heating of commercial titanium over 1100° contributes to the diffusion of O_2 and N_2 into the metal and the formation of a brittle phase on the surface. (Q23; Ti)

197-Q. (Report.) **Investigation of the Compressive, Bearing and Shear Creep-Rupture Properties of Aircraft Structural Metals and Joints at Elevated Temperatures, Part 1.** F. J. Vawter and others, Cornell Aeronautical Laboratory, Inc. for Wright Air Development Center. 194 p. June 1956. U. S. Office of Technical Services, PB 121436. $2.50.

Equipment and special fixtures for conducting tensile, compression, bearing and shear creep tests. Data on 2024-T3 aluminum sheet, C-110M titanium sheet, type 321 stainless steel sheet, and rivet wires of 2117-T 4 aluminum, Monel, and type-301 stainless steel, 24S-Ts aluminum sheet and 24S-T3 aluminum plate. (Q3, X29; Al, Ti, SS, Ni)

198-Q. (Report.) **Investigation of Compressive-Creep Properties of Aluminum Columns at Elevated Temperatures, Pt. 4—Additional Studies.** R. L. Carlson, E. G. Bodine and G. K. Manning, Battelle Memorial Institute for Wright Air Development Center. 80 p. April 1956. U. S. Office of Technical Services, PB 121465. $2.00.

Creep buckling of columns at elevated temperatures. Data for short inelastic columns of aluminum

alloy, square tubing columns of aluminum alloy, and columns of stainless steel. (Q3c; Al, SS)

199-Q. (Book.) **Defects and Failures of Metals: Their Origin and Elimination.** E. P. Polushkin. 339 p. 1956. Elsevier Publishing Co., 445 Park Ave., N. Y. 22, N. Y., and D. Van Nostrand Co. Inc., 257 Fourth Ave., New York 10, N. Y. $12.50.

Deals with segregation, blowholes, pipe, decarbonization, scaling, residual stresses, embrittlement, fatigue, flakes, cracks, wear, corrosion and other defects. References follow each chapter. (Q general, R general, 9)

200-Q. (Book.) **International Conference on Fatigue of Metals.** v. I-III. Papers individually paged. 1956. The Institution of Mechanical Engineers, 1 Birdcage Walk, London, S. W. 1, England.

Numerous papers dealing with stress distribution; effects of temperature, frequency, and environment; metallurgical aspects of fatigue; basic mechanisms; and engineering and industrial significance of fatigue. Pertinent papers are abstracted individually. (Q23g, Q7)

201-Q. (Book.) **Relaxation Properties of Steels and Super-Strength Alloys at Elevated Temperatures.** 104 p., 1956. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. (Special Technical Publication No. 187) $4.00.

Summary of data on relaxation strengths for low-alloyed Mo, Cr, and V-bearing steels, 12% Cr-type steels, a number of super-strength alloys and cast iron.
(Q23d, 2-12; AY, SS, CI)

202-Q. (Book.) **Fatigue in Aircraft Structures—Proceedings of the International Conference held at Columbia University, Jan. 30, 31 and Feb. 1, 1956.** Edited by Alfred M. Freudenthal, 456 p. 1956. Academic Press, 111 Fifth Ave., New York 3, N. Y. $12.00.

Papers on the general problem of fatigue in metals, fatigue in steel and aluminum, and fatigue in metal aircraft parts. Papers separately abstracted. (Q23f, Q7, T24a)

203-Q. (Book—Russian.) **Mechanical Properties of Isothermally Hardened Steel.** A. S. Meyseyenke, 141 p. 1956. Mashgis, Kiev-Moscow, U.S.S.R.

Investigation of the mechanical properties of medium carbon, high carbon and alloy toolsteels subjected to isothermal hardening to martensite. The effects of hardening temperature and soaking time, isothermal soaking in the quench bath, low-temperature tempering, and the cold treatment of hardened steel upon mechanical properties have been demonstrated. The mechanical properties of steels subjected to ordinary hardening are cited for purposes of comparison. 89 ref.
(Q general, J general; TS)

204-Q. (Book—Russian.) **Steels and Alloys for Service at High Temperatures.** M. L. Bernshteyn, 239 p. 1956, Metallurgizdat, Moscow, U.S.S.R.

Theory of heat resistance; data on the properties and treatment of heat resistant ferrite, pearlitic and austenitic steels and heat resistant nickel, cobalt, chromium, titanium and molybdenum-based alloys. Results of the study of the structure of heat resistant steels and alloys. 194 ref.
(Q general, 2-12; SGA-h, SS, Ni, Co, Cr, Ti, Mo)

R Corrosion

54-R. A.S.T.M. Copper-Strip Corrosion Standards. R. C. Mallatt, P. A. Demkovitch and W. V. Cropper. *A.S.T.M. Bulletin,* no. 218, Dec. 1956, p. 49-51.

Mass reproduction of the standard strips using aluminum sheet, colored and cut to size, is reported. (R11, S22; Cu, Al)

55-R. Defect Test on U-2 w/o Zr Alloy in the X-2 Loop Test No. 1. R. F. S. Robertson and F. H. Krenz. *Atomic Energy of Canada Limited. CRDC-646,* April 1956, 32 p. (CMA)

A defected specimen of U-2Zr alloy, clad with Zircaloy-2 and diffusion bonded, was irradiated in a loop of a nuclear reactor. The loop contained water at 550° F. under 2000 psi. The object was to find if the corroding core metal released radioactive products in detectable amounts into the hot water, and to determine if the detection could be made in time to shut down the reactor. The defect (a hole) was plugged at first and no corrosion products entered the water. When the hole was opened they entered rapidly, while corrosion continued under the sheath. Detection is quick and allows shut down in time. (R11, S19; U, *Zr,* 9)

56-R. Stress-Corrosion Cracking of Brass. *Corrosion Technology,* v. 3, Dec. 1956, p. 407.

Study by the U.S. National Bureau of Standards on the relationship between crystal orientation and corrosion in alpha and beta brasses.
(R1d, 3-22; Cu)

57-R. Researches on Corrosion and Inhibition; Reaction Velocity of the System Iron-Dilute Acetic Acid at 40° C. George S. Gardner. *Franklin Institute, Journal,* v. 262, Dec. 1956, p. 469-478.

Effects of inhibitors with and without addition of mineral spirits. (R10b)

58-R. Aluminized Steel Stands Off Atmospheric Corrosion. J. C. Merritt and W. E. McFee. *Iron Age,* v. 178, Dec. 27, 1956, p. 60-61.

Report on Armco aluminized steel Type-2 telling of its high resistance to atmospheric corrosion, good fabricating properties and favorable comparable costs.
(R3, G general; ST, *Al,* 8-19)

59-R. High Alloys Committee. V. N. Krivobok. *Welding Research Council Yearbook,* 1956, p. 39-40.

The Arcos Corp. investigation on the effect of weld metal composition on the properties of Type-347 steel welds and the study being conducted by the Field Corrosion Subcommittee on the corrosion resistance of austenitic steel weldments are discussed.
(R general, Q general; SS, 7-1)

60-R. The Corrosion Behavior of Zirconium and Its Alloys in High-Temperature Water and Steam. S. Kass. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 39-46. (CMA)

The corrosion of zirconium and its alloys in hot water proceeds by a low quasi-cubic rate law which transforms to a linear law. Small additions of iron, nickel or chromium, in conjunction with tin, improve corrosion resistance. Effects of impurities, such as titanium, aluminum, calcium, magnesium, chlorine and silicon, on the corrosion resistance are considered; most additions, other than those noted, are harmful. The high corrosion resistance of Zircaloy-2 is discussed. (R4d, 2-10; Zr)

61-R. Preservation of Stored War Material. J. L. McCloud. *Metal Progress,* v. 70, Dec. 1956, p. 84-85.

Favored method of protection against corrosion is storage under tight cover within which is circulated an atmosphere of controlled humidity. Vapor-phase inhibitors and contact preservatives also used. (R10e, R10b, T2)

62-R. Millions to Combat Rust. *Railway Age,* v. 142, Jan. 7, 1957, p. 25-27, 34.

International Nickel spends $7-million annually on research, much of it for research on corrosion resistant alloys and other corrosion problems. (R general, A9m; SGA-g)

S Inspection and Control

45-S. Ultrasonic vs. Radiographic Inspection of Bonded and Brazed Assemblies—an Evaluation. Earl R. Weiher. *American Machinist,* v. 100, Dec. 17, 1956, p. 121.

Inspection of honeycomb sandwich; ultrasonics effective for adhesive bonded assemblies, radiography better for brazed assemblies. (S13e, S13g; 7-2, 7-8)

46-S. Radiography Tests Brazed Stainless Sandwich. S. Maszy. *American Machinist,* v. 100, Dec. 17, 1956, p. 125-127.

Unique radiographic inspection technique by which all brazed honeycomb construction may be 100% inspected. (S13e; SS, 7-2)

47-S. Spectrophotometric Determination of Aluminum in Titanium and Titanium Alloys. An Aluminon Method. D. K. Banerjee. *Analytical Chemistry,* v. 29, no. 1, Jan. 1957, p. 55-60. (CMA)

A fast method of estimating the aluminum in titanium uses aluminon and is adapted to routine work. The range of 0.1-1.0% Al is covered by conventional colorimetry and the 1.0-10.0% range by differential spectrophotometry. The absorbance maximum is 540 mμ. Reagents are enumerated and procedures recommended. 11 ref. (S11; Ti, *Al*)

48-S. Separation and Determination of Microgram Amounts of Molybdenum. G. R. Waterbury and C. E. Bricker. *Analytical Chemistry,* v. 29, Jan. 1957, p. 129-135. (CMA)

Micro-amounts of molybdenum in the presence of iron may be separated and determined in plutonium alloys by extracting molybdenum into hexone from a 6M HCl solution, back-extracting into water, precipitating iron, and colorimetrically estimating molybdenum using chloranilic acid as the color reagent. Only tin, tungsten and bismuth interfere seriously. Reliability is good. (S11; *Mo,* Pu)

49-S. How Simpler Steel Specifications Lower Costs. *Iron Age,* v. 178, Dec. 13, 1956, p. 132-134.

Ford Motor Co. achieves cost reduction by specifying end properties desired, not specific steel or processing technique. (S22, A4s)

50-S. X-Ray Spectrograph Eliminates Production Bottleneck. Vern W. Palen. *Iron and Steel Engineer,* v. 33, no. 12, Dec. 1956, p. 151-155.

X-ray technique for determining amounts of lead dispersion in steels; casting techniques for attaining uniform distribution of lead in steel. (S11p, D9k; ST, *Pb*)

51-S. Classification of Contractors' Standards for the Procurement of Bureau of Aeronautics Aluminum and Magnesium Castings. E. L. Criscuolo and N. Modine. *Nondestructive Testing,* v. 14, no. 6, Nov.-Dec. 1956, p. 28-31.

An analysis of contractors' radiographic standards on grade distribution, frequency of defects, acceptable grade level, and film-to-casting ratio. (S13e, S22; Al, Mg, 5)

52-S. Considerations Affecting Future Pressure-Vessel Codes. J. J. Murphy, C. R. Soderberg, Jr., and D. B. Rossheim. *Welding Research,* v. 21, Dec. 1956, p. 582s-596s.

Basic principles for revision of the ASME pressure-vessel codes to a broader base to suit the wide variations in service and economic demands. 18 ref. (S22, T26q, K general)

53-S. Principles of Shipyard Radiography. E. J. Duffy. *Welding and Metal Fabrication,* v. 24, no. 12, Dec. 1956, p. 442-446.

X-ray and gamma-ray equipment and shipyard radiographic inspection practice. (S13e, T22)

54-S. (French.) **Spectrophotometric Determination of Phosphorus in Iron Castings.** L. Baraicovich and M. F. Landi. *Fonderie,* no. 129, Oct. 1956, p. 381-388.

Method proposed by W. G. Boyer superior to classic method in accuracy; suitable for determination of P in ferro-manganese carbide. (S11k; CI, *P*)

55-S. Determination of Small Amounts of Cobalt in Steels and Nickel Alloys by the Isotope Dilution-Anodic Deposition Method. Darnell Slayer and Thomas R. Sweet. *Analytical Chemistry,* Jan. 1957, p. 2-4.

Method involving cobaltinitrite separation, isotope dilution, and anodic electrodeposition. Time of standing of the cobaltinitrite precipitate is 30 min. (S11; ST, Ni, *Co*)

56-S. First Results of the Intensive Use of Ultrasonics for the Detection of Axle Flaws. E. Meyer. *International Railway Congress Association Monthly Bulletin,* v. 33, Dec. 1956, p. 973-984.

Experience with the apparatus satisfactory; solid axels which are fractured can be detected and removed; Operating expenses are lower. (S13g, T23)

57-S. Volatile Impurities in Silicon and Germanium. Harold A. Papazian and Sumnev P. Wolsky. *Journal of Applied Physics,* v. 27, Dec. 1956, p. 1561.

Mass spectrographic analysis of the volatile impurities present. Impurities are hydrogen, water, carbon monoxide, carbon dioxide and nitrogen. (S11c; Si, Ge, 9-1)

58-S. The Detection of Rolling Defects in Steel Sheet. A. M. Armour. *Metallurgia,* v. 54, Dec. 1956, p. 301-304.

Methods discussed involve ultrasonic, mechanical, electrical and magnetic processes. (S13, 9-21; ST, 4-3)

59-S. Cathode Ray Polarography. J. W. Martin and J. W. Westwood. *Metallurgia,* v. 54, Dec. 1956, p. 305-311.

Techniques employed and applications, including determination of impurities in metal ores. 31 ref. (S11m; RM-n, 9-1)

60-S. Inspection and Testing Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 306-314.

Thirteen of the industry's authorities briefly give significant developments. A few of these are automatic hardness testing, use of fluorescent magnetic particles in steel mills and increasing use of ultrasonics. (S general, Q general)

61-S. (Japanese.) **Photometric Determination of Zirconium in Magnesium and Aluminium Alloys.** S. Hashimoto and S. Kato. *Light Metals,* v. 11, no. 21, 1956, p. 76-84. (CMA)

A photometric method for determining zirconium in aluminum and magnesium is based on sodium alizarin sulphonate. The procedure is outlined. Absorbencies are measured at 520 m. The dissolution with dilute HCl, to separate acid-soluble from acid insoluble zirconium, was very satisfactory. (S11a; Mg, Al, *Zr*)

62-S. (English.) **Studies on the Flame Spectrochemical Analysis. Pt. V. Determination of Manganese.** Shigero Ikeda. *Science Reports of the Research Institutes, Tohoku University,* v. 8, Dec. 1956, p. 449-456.

Influences of various acids and elements; calibration curve for manganese; determination of manganese in ferromanganese alloy. (S11a; AD-n31, *Mn*)

63-S. (English.) **Studies on the Flame Spectrochemical Analysis. Pt. VI. Determination of Strontium.** Shigero Ikeda. *Science Reports of the Research Institutes, Tohoku University,* v. 8, Dec. 1956, p. 457-462.

Influences of diverse acids and elements; calibration curve of strontium; determination of strontium in shell and limestone. (S11a; Sr)

T Metal Products and Parts

15-T. 100 Per Cent Increase in Use of Aluminum for Automobile Trim. *Automotive Industries,* v. 115, Dec. 15, 1956, p. 48-49, 142.

Aluminum used in body, transmission, power steering and many other parts, 40-45 lb. being used in average 1957 car; this is expected to increase to 150 by 1960. (T21b; Al)

16-T. Metallurgy in Music Making. H. H. Symonds. *Birmingham Metallurgical Society, Journal,* v. 36, Dec. 1956, p. 431-463.

Use of metals in strings, organ pipes, belts, whistles, wind instruments, piano frames and records. (T9r)

17-T. Fabrication of Fuel Elements for Nuclear Reactors. *Engineer,* v. 202, No. 5262, Nov. 30, 1956, p. 788-791.

Most of the fuel elements being manufactured are of the flat form. Deals with flat elements and reviews special fabrication methods required in production. (T11, G general)

18-T. Performance of Light Metals at Elevated Temperatures. Alan V. Levy. *Light Metal Age,* v. 14, Dec. 1956, p. 12-15, 37.

List of high-temperature alloys; factors involved in selecting alloys for aircraft and missile applications; fabrication of high-temperature alloys. Magnesium and titanium alloys are emphasized. (T24, T2, 2-12; Mg, Ti)

19-T. Boron Carbide Looks Promising for Nuclear Uses. Charles W. Henson. *Materials and Methods,* v. 44, Dec. 1956, p. 97-98.

Chemical and physical properties of boron carbide; forming and designing, molding and bonding for nuclear uses. (T11; B, NM-a 35)

20-T. Selecting Nickel Alloy Wire. David Schmid. *Materials and Methods,* v. 44, Dec. 1956, p. 100-105.

Detailed data and recommendations to aid in the selection of the best wire for specific applications. (T general; Ni, 4-11)

21-T. Magnesium-Thorium Alloy for High Speed Aircraft. *Materials and Methods,* v. 44, Dec. 1956, p. 139-141.

Mechanical properties at elevated temperatures and fabrication of magnesium-thorium alloy. (T24, Q general, 2-12; Mg, *Th*)

22-T. In the '57 Cars Aluminum Scores Big Gains. Kim Darby. *Modern Metals,* v. 12, Dec. 1956, p. 33-37.

Functional and ornamental use of aluminum in automobiles increased from an average of 35 lb. last year to 42 lb. for the 1957 models. (T21; Al)

23-T. Big Extruded Signs Guide Superhighway Traffic. V. H. Menking. *Modern Metals,* v. 12, Dec. 1956, p. 50-55.

Extruded interlocking aluminum panels form highway signs. (T10; Al)

24-T. Calder Hall; Metallurgical Development. *Nucleonics,* v. 14, Dec. 1956, p. s14-s15.

Casting of uranium in graphite molds chosen on economic grounds. Magnox C, with calcium omitted, selected for reactor canning. (T11, C5; U)

25-T. Glassed Steel Apparatus. John W. Cosier. *Paint Industry Magazine,* v. 71, Dec. 1956, p. 52-60.

Chemical company uses glass-lined steel vessels in manufacture of fuchsine and cresol. (T29; ST, NM-f42)

26-T. Pressure Vessel Research. F. L. Plummer. *Welding Research Council Yearbook,* 1956, p. 19-26.

Report on accomplishments, objectives, current and future work of the Pressure Vessel Research Committee. 59 ref. (T26q)

27-T. Can Beryllium Buck Brittleness to Play Major Airframe Role? George A. Hoffman. *Western Metals,* v. 14, Dec. 1956, p. 48-51.

Usage could reduce plane weight 50% but at present brittleness, toxicity and high cost are effective. deterrents. (T24a; Be)

28-T. Carborundum Metals Company Products Available. H. A. Anderson. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 75-77. (CMA)

The reactor grade zirconium sponge produced by Carborundum Metals Co. discussed and the production of Hf-2% Zr sponge noted. The present production of reactor grade is adequate for AEC needs and potential needs of foreign and domestic reactor markets; immediate deliveries can be made. Exacting specifications for arc-melting and chemical analysis of zirconium are noted. It is suggested that commercial-grade zirconium be given

more consideration in reactor construction where neutron absorption is subsidiary in importance. The firm also produces ZrNCN, ZrO_2, $ZrCl_4$ and zirconium powder.
(T11, C5h; Zr)

29-T. Commercial Products Available. A. R. Matheson. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 89. (CMA)

The arc-melting of zirconium and uranium for fabrication into fuel elements, and the rolling of thin-gage zirconium strip are two interests of the Metals and Controls Corp. (Nuclear Products Div.). One project in the course of development is the cladding of uranium foil with zirconium strip. Scrap use in arc-melting.
(T11, C5h, F23, L22; Zr, U)

30-T. Commercial Products Available. P. Lowenstein. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 93. (CMA)

Nuclear Metals, Inc., has worked for some time on zirconium under AEC contract. Research and development services are the firm's specialty but mill products are also fabricated. The two outstanding mill products formed are uranium fuel elements clad with zirconium, and the cladding of seamless zirconium tubing. Extruded tubing is much cheaper than cold finished tubing. A process of cladding iron tubing with zirconium has been developed.
(T11, L22; Zr, U)

31-T. AEC Future Requirements. R. C. Dalzell. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 101-105. (CMA)

In the course of two years, zirconium needs of the AEC have risen from 175,000 to 900,000 lb. yearly. Other government agencies may also have demands for zirconium. Several types of nuclear reactors are briefly described and all are likely to require zirconium in constructions. Discussion is appended.
(T11; Zr)

32-T. Industrial Requirements for Zirconium. M. F. Judkins. Paper from "Zirconium—Technology and Economics". Atomic Industrial Forum, p. 107-109. (CMA)

The potential commercial zirconium market depends mainly on its corrosion resistance. With more fabricated forms available, full-scale plant tests on the chemical behavior of zirconium may be conducted; sponge zirconium costs much less than tantalum. Present uses of zirconium in process industries include rayon spinnarets, water jet exhausters and spray nozzles. Electronic uses of zirconium are noted. The resistance of zirconium in various corrosive media is described.
(T general, R general; Zr)

33-T. Characteristics of Tantalum Electrolytic Capacitors. Albert Lunchick and Emanuel Gikow. *Electrical Manufacturing,* v. 58, Dec. 1956, p. 79 + 10 pages.

Direct current leakage, dissipation factor, low-temperature characteristics, changes in high temperature, effect of overvoltage and humidity evaluated. (T1; Ta)

34-T. Titanium and Its Uses. *Industrial Finishing,* v. 9, Dec. 1956, p. 290-291. (CMA)

The food processing industry intends to use titanium in processing foods like pickles and tomatoes, while the pharmaceutical industry is attracted to titanium because decreased corrosion means less contamination. The use of titanium in steam jet diffusers for environments containing HCl, in experimental auto bodies and in marine service is described. It has become increasingly important to minimize the hydrogen content, and descaling baths have been developed with this in view. The Baylig process, an electrolytic pretreatment of titanium, gives it a hard chromium coat.
(T general; Ti, 17-7)

35-T. Manufacturing Under a Microscope. *Steel,* v. 139, Dec. 17, 1956, p. 91-92.

Success of mass production of transistors dependent on close control during growth of germanium-indium alloy. (T1, C general; Ge, In)

36-T. Tooling and Gauging Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 353-364.

Fifteen authorities each contribute a paragraph on what they find to be the most significant recent developments. Contributions include greater use of automatic gages, production use of ceramic tools.
(T6, X20)

37-T. (German.) **Carbide Tipped Cutter Drill Tools.** H. Hansherg. *Fertigungstechnik,* v. 6, Dec. 1956, p. 535-539.

A review of carbide-tipped cutter drill tools to show them in present use and for furthering their utility in industry. (T6, 6-19, 17-7)

38-T. (Pamphlet.) **1955 Suplement to the Bibliography and Abstracts on Electrical Contacts.** 41 p., 1956. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. (Special Technical Publications No. 56-J.) $1.00.

References on a wide variety of subjects including conductivity of thin metallic films, contacts fabricated from powdered metals, and properties of contact materials.
(T1; SGA-r)

39-T. (Report.) **Stainless Steel for Pressure Vessels.** A. Grodner. 20 p., Nov. 1956. *Welding Research Council Bulletin Series.* No. 31. $1.00.

Properties and fabrication characteristics of wrought and cast stainless steels used for pressure vessel construction to meet requirements of processing industries. (T26; SS)

40-T. (Book.) **Bearing Design and Application.** Donald F. Wilcock and E. R. Booser. 470 p., 1957. McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. $12.50.

Deals with the design of bearings, the materials from which the working parts are made, and the lubricants. Rolling element bearings, slider bearings, and troubleshooting are covered. (T7d, 17-7)

41-T. (Book.) **Engineering Structural Failures.** Rolt Hammond. 224 p., 1957. Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. $12.00.

Causes and results of failure in modern structures of various types: earthworks, dams, maritime structures, buildings, underground structures, and welded structures; lessons of failure. (T26, 7-1)

W Plant Equipment

16-W. High-Rake Cutters Triple Life and Speed on High-Tensile Steels. Peter Trippe. *American Machinist,* v. 100, Dec. 31, 1956, p. 81.

Cutter life and speed can be multiplied by three with high-rake cutters, when high-tensile steels are cut, according to British tests.
(W25, G17; AY)

17-W. Contamination and Corrosion in Rail Tank Cars. S. John Oechsle, Jr., and Kenneth G. LeFevre. *Corrosion Technology,* v. 3, Dec. 1956, p. 89-92.

Aluminum and stainless steel cars seem to be the ideal solution, but less than 2% of 174,000 tank cars in United States are so constructed because of the initial cost. Recent investigation indicates that protective linings can do the job.
(W12, 17-7, R general; Al, SS)

18-W. Axial Blast-Furnace Blower. *Engineer,* v. 202, no. 5262, Nov. 30, 1956, p. 783-784.

The installation supplies air to a furnace for which pressure and quantity of the blast required at present are well below the designed maximum. (W17, D1b)

19-W. All-Gas Furnaces Prove Most Economical for Milwaukee Forge Co. *Industrial Gas,* v. 35, Dec. 1956, p. 10-11.

Savings in metal are effected by using direct gas-fired forge furnaces in the production of weldless rolled rings. (W23)

20-W. Comparison Chart of Gas Welding Rod, Bare Electrodes, Automatic Welding Wires and Metal Spray Wires. *Industry and Welding,* v. 30, Jan. 1957, p. 50-51.

Data for use in selecting proper equipment for various applications.
(W29)

21-W. Iron Powder Electrodes Speed Welding by 40 Percent. *Industry and Welding,* v. 30, Jan. 1957, p. 81-82.

Fast, one-pass welding of 3/8-in. fillets made possible by iron powder electrodes. (W29; Fe)

22-W. Handle Press Scrap Fast for Bigger Profits. J. E. Hyler. *Iron Age,* v. 178, Dec. 13, 1956, p. 130-131.

Methods of collection and disposal depended on type and volume of scrap, scrap wanderers, conveyors or magnets used. (W12; AD-b)

23-W. Scrap Bailers: Put Your Money Where it Counts Most. J. E. Hyler. *Iron Age,* v. 178, Dec. 20, 1956, p. 80-82.

Points to consider before the selection of scrap bailer. (W15; RM-p)

24-W. Power Requirements and Selection of Electrical Equipment for Reversing Cold Strip Mills. J. E. Peebles. *Iron and Steel Engineer,* v. 33, no. 12, Dec. 1956, p. 102-120.

Mill stand and reel drive requirements, selection of horsepower, mill stand motor rating, reel motor rating, reel tension vs. motor rating, selection of motors for pull-through mill, rectifiers, control of reel motors, tensiometer control of reel, control of pull-through mill, operator's control stations and motor room layout. (W22; ST, 4-3)

25-W. The Production of Openhearth Steel With Particular Reference to Roof Life. C. D. H. Walker, H. R. Curnick and N. E. Dobbins. *Iron and Steel Institute, Journal,* v. 184, Dec. 1956, p. 410-413.

Instrumentation of openhearth furnace; physical and chemical properties of brick in the furnace; X-ray powder photographs of bricks of each zone. 16 ref. (W18, X9; RM-h)

26-W. Multiple Clamps Insure Accurate Heliarc Welding. George Brolaski and Wells McGregor. *Machinery,* v. 63, Jan. 1957, p. 148-151.

Design and fabrication of fixtures for use with new welding equipment, each fixture being made for a particular job. (W29)

27-W. How Are Your Carbide Tools Performing? Part I. J. F. Allen. *Machinery,* v. 63, no. 5, Jan. 1957, p. 166-172.

Chip breakers and tool wear discussed. (W25, Q23f, 6-19)

28-W. Modern Die Making Machines; Some Recent and Future Possibilities for the Drop-Forging Industry. W. E. Golcher. *Metal Treatment And Drop Forging,* v. 23, Dec. 1956, p. 475-480.

Application of tracer copying mechanisms; die millers with built-in originating features; tape-controlled milling machines; automatic milling by computer control. (W25, W23)

29-W. Annealing With Superfast Cooling Option. Lester E. Alban and Harrold J. Bates. *Steel,* v. 139, Dec. 3, 1956, p. 150-152.

Annealing furnace designed to meet requirements of gear manufacturer handling wide assortment of forgings has superfast cooling zone which can be bypassed if desired. (W27, J23; 4-1)

30-W. Mine Equipment and Machine Tools Fabrication Shops at Sheepbridge Engineering, Ltd. *Welding and Metal Fabrication,* v. 24, no. 12, Dec. 1956, p. 424-430.

Facilities for mass production of mine cars and a great variety of metal forming described. (W14, W25)

31-W. New Fabrication Shop for Positioners. *Welding and Metal Fabrication,* v. 24, no. 12, Dec. 1956, p. 440-441.

Facilities of F. Bode and Son, Ltd., for manufacturing positioners and manipulators for the fabrication industry. (W29)

32-W. "Cascade" Heater Offers Savings in Fuel, Maintenance Costs on Finishing Line. *Western Metals,* v. 14, Dec. 1956, p. 64-65.

Efficiently heats phophate coatings solution. (W3, L14b)

33-W. Simplified Materials Handling Paves Way for Job Shop Conversion to Mass Production. Howard B. Jackson. *Western Metals,* v. 14, Dec. 1956, p. 66-68.

Improved material handling allows production of specialty items as hedge against cut-backs in job orders. (W12)

34-W. (French.) **Equipment for Surface Treatment.** M. Salvaresi. *Metallurgia et la Construction Mecanique,* v. 88, no. 11, Nov. 1956, p. 957-965.

General principles in selection of equipment for surface treatment; dip, spray and manually operated equipment. (W3)

35-W. (Japanese.) **Design of Permanent Magnet Generators.** Kazuyuki Shinoi. *Metals,* v. 26, Dec. 1956, p. 933-937.

Nature of magnets; magnetic adhesion; design of generators. (W11, 17-1; SGA-n)

36-W. Maximum Utilization of Wide-Strip Rolling Equipment. H. H. Ascough and M. I. Meach. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 579-588.

Planning the layout of high-production mills so that the various units maintain a balance of output. (W22, 4-3)

37-W. Rolled Contoured Wing Skins With Finger Tip Controls. Eugene Harp. *Machine and Tool Blue Book,* v. 52, Jan. 1957, p. 137-139.

Standard radial arm router modified so that operator with fingertip controls can adjust the router head to any vertical setting within the limits of the machine. (W24)

38-W. Submerged Arc Welding. *Machinery Lloyd (Overseas Edition),* v. 28, Dec. 8, 1956, p. 83-84.

Automatic equipment (Lincoln Electric Co. Ltd.) consists essentially of a highly responsive d-c. control circuit including an exciter control on the welding generator, a d-c. motor for wire feed and rheostat adjustment of arc voltage, welding current and travel speed. (W29)

39-W. Faster Charge for Open Hearth. *Steel.* v. 139, Dec. 24, 1956, p. 70.

Increased tonnage with new 61-cu. ft. charging boxes. (W18, D2a)

40-W. Huge New Stress-Relieving Furnace Aids Heavy-Duty Fabrication in Bay Area. *Western Machinery and Steel World.* v. 47, Dec. 1956, p. 73.

Furnace is able to accommodate pieces 40 ft. or longer and contains four heat zones. (W27)

X Instrumentation

Laboratory and Control Equipment

7-X. Strain Gage for the Measurement of Strains in Adhesive Bonds. C. B. Norris, W. J. James and J. T. Drow. *A.S.T.M. Bulletin,* no. 218, Dec. 1956, p. 40-49.

Method for measurement of tensile strain in a thin adhesive bond between metallic adherents. (X29; NM-d34)

8-X. Super-Strong Magnets. *Chemical & Engineering News,* v. 35, Jan. 14, 1957, p. 76-78.

General Electric's new magnets will enable instruments to be made lighter and more compact. Material is composed of elongated "whiskers" of iron. (X general, 17-7, P16; SGA-n, Fe)

9-X. Raw Material Inventory Through Photogrammetry. Robert A. Cummings, Jr. *Iron and Steel Engineer,* v. 33, no. 12, Dec. 1956, p. 135-137.

Accurate raw material inventory is difficult. Method described is photogrammetry, using aerial photography, field control and third dimensional compilation. Data given for the estimation of weight of raw materials. (X5, A5, RM)

10-X. Instrumentation in the Heat-Treatment of Steel. Part I. The Nature of the Problem. W. F. Coxon. *Metal Treatment and Drop Forging,* v. 23, Dec. 1956, p. 499-502.

Necessary instruments for furnaces; atmosphere control; typical heat treatment defects. (X7, X9, J general, 9; ST)

11-X. Computers Speed Design. *Steel,* v. 139, Dec. 31, 1956, p. 61.

Computer solves mathematical problem in motor design. (X14, W25, 17-1)

12-X. Photoelectric Cells Speed Mill Production. *Steel,* v. 139, Dec. 31, 1956, p. 64, 66.

Controls length of bars and rods with great accuracy. (X10, W22, 4-5)

13-X. (Japanese.) **Design, Selection and Applications of Permanent Magnets in Communication Equipment.** Shizuo Kishi. *Metals,* v. 26, Dec. 1956, p. 923-928.

Design of permanent magnets: selection, BH point, retentivity, magnetic circuits and hysteresis curves; examples of circuits; application of permanent magnets to hand generators, receivers, magnetic bells, relays and loud speakers. 5 ref. (X15, 17-7; SGA-n)

14-X. (Japanese.) **Application and Design of Permanent Magnets as Measurement Instruments.** Sonsei Izawa. *Metals,* v. 26, Dec. 1956, p. 929-932.

Stability of permanent magnets, relationship between safety ratio and ratio of natural magnetic reduction. Design and application of permanent magnet measurement instruments. (X general, P16; SGA-n, 17-7)

15-X. An Apparatus for the Determination of Stress-Strain Properties at High Rates of Strain. R. J. MacDonald, R. L. Carlson and W. T. Lankford. *Proceedings of the Society for Experimental Stress Analysis,* v. XIV No. 1, p. 163-170.

Total strain rates ranging from ¼ to 190 in. per. min. were obtained using a 10-ton Denison hydraulic press in conjunction with a specially designed subpress. Stress-strain curves indicate the effects of a range of strain rates and temperatures on the initial yielding behavior of low carbon steel. (X29, 3-17, Q24c, 2-11)

16-X. Static and Dynamic Calibration of a Photoelastic Model Material, CR-39. A. B. J. Clark. *Proceedings of the Society for Experimental Stress Analysis,* v. XIV. No. 1. p. 195-204.

Measurements of strain and birefringence for effective loading times in the range of 10 min. and 10^{-4} sec. Two methods of determining the effective gage factor for wire resistance strain gages used on this resin. (X29, 3-17; NM-d)

17-X. Drives and Controls Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 317-330.

Ten executives of the industry comment briefly on the new developments, some of which are punched card programming for rolling mills, design of simplified control components. (X general)

18-X. New Tape Control System for Standard Machine Tools. L. S. Peck. *Western Machinery and Steel World,* v. 47, Dec. 1956, p. 58-60.

Digital information from magnetic tapes is translated into pulse trains actuating and controlling machine tool movements, providing numerical control to small-lot production on standard machines. (X14, W25)

19-X. (German.) **Manufacture and Use of Copper-Plated Steel Telephone Line Wire of High Strength.** *Metall,* v. 10, no. 21-22, Nov. 1956, p. 1038-1041.

Characteristics and advantages in use of copper-plated steel wires for telephony. (X15, 17-7; ST, *Cu*, 8-12)

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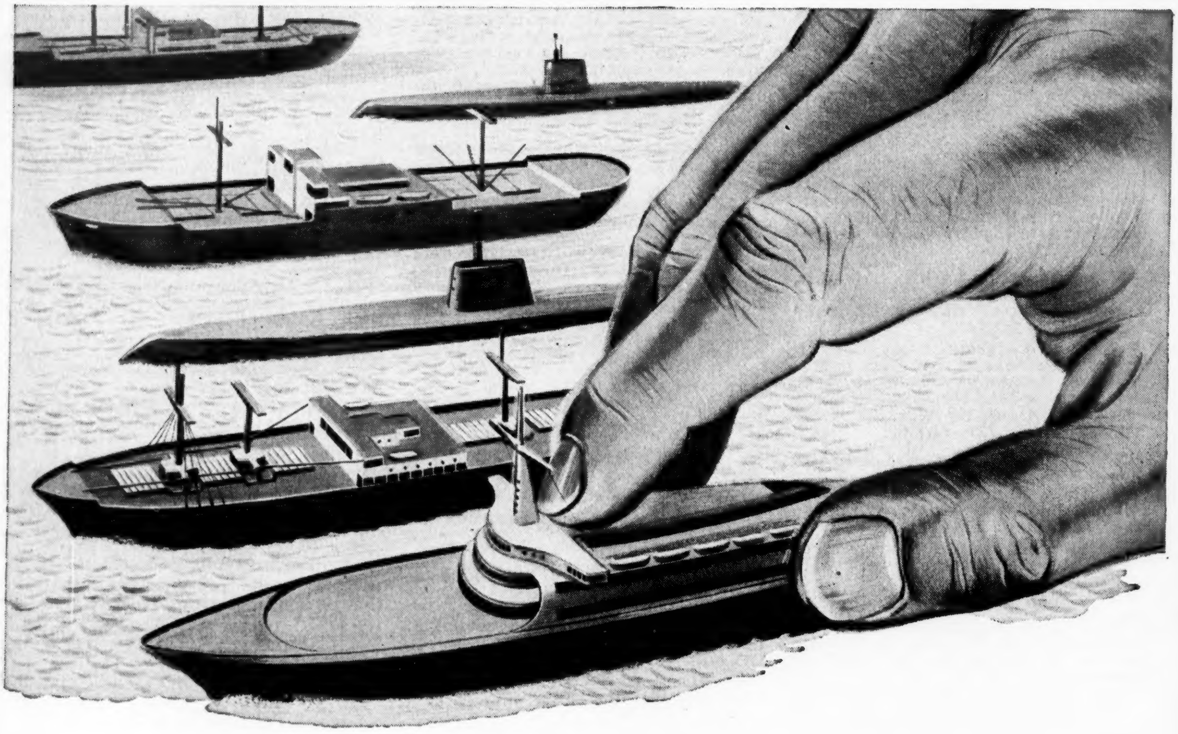

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POSITIONS OPEN

Midwest

METALLURGIST: Chicago area, nationally known manufacturer of metal fastenings seeks graduate metallurgical or chemical engineer with training and experience necessary to assume supervision of metallurgical control program and laboratory. Electroplating and heat treating background desirable. Reply will be held in strict confidence and should include details of education and work experience. Box 2-5.

METALLURGISTS: New integrated metallurgical pilot plant has opportunities for development and production work. This plant involves vacuum, induction and cold hearth melting; specialty castings; forging; rolling; heat treating; powder metallurgy processes. These processes produce high-temperature, nuclear fuel, magnetic and other specialty alloys. Box 2-10.

PROCESS ENGINEER: New and fast growing titanium company has position open for manager of processing to have responsibility for processing titanium from ingot through to rod and wire, for quality control, and for production process research and development. Salary commensurate with ability and performance. Excellent opportunity for young man to develop in management. In reply, state qualifications, experience, etc. Box 2-15.

GENERAL MANAGER: Metallurgically trained, to become chief executive of new company in rapidly growing field of vacuum melted steels and other alloys. Applicant should be prepared to assume full managerial responsibility. Participation in company growth and profits. In reply, state experience, qualifications, etc. Box 2-20.

PLANT SUPERINTENDENT: From $9000 to $12,000. Top manufacturing position in medium-size heavy machine job shop. Should have minimum of eight years supervisory experience in machine shop and resistor manufacturing with good knowledge of electrical and hydraulic functions. Age 33 to 50. West Virginia location. In reply give brief summary including age, education and experience. Box 2-25.

METALLURGIST: Unusual opportunity. Young, ambitious metallurgist with some writing ability to assist with preparation of home study courses in practical metallurgy. Friendly surroundings, interesting work, excellent opportunities for advancement. Box 2-105.

East

METALLURGIST: Graduate with some experience in metal processing, heat treating of alloy steels, stainless and other alloys. Knowledge of metallography required. Research experience and nonferrous experience desirable but not necessary. Aircraft accessory company in upstate New York. Salary depends on qualifications. Box 2-30.

RESEARCH METALLURGIST: Immediate appointment. Industrial research background and Ph.D. desired. Responsibilities include supervision of metallurgical research program in Engineering Experiment Station. Faculty status, opportunity to teach in college of engineering if desired. Salary commensurate with qualifications. Country campus in attractive, historic, small New England town, five miles from excellent beaches, on main line railroad between New York and Boston, and within commuting distance of Providence. Ideal location for person who wants spacious living and summer resort facilities not too far from the city. Send resume to: Dean T. Stephen Crawford, College of Engineering, University of Rhode Island, Kingston, R. I.

METALLURGIST: For producer of stainless steel. Quality control of stainless ingot production; customer service contacts related to special usage. Plant located on central East Coast. Metallurgical graduate, stainless experience preferred but not essential. Permanent position, good salary with merit increases. In reply please give personal data, education, employment history, salary desired. Box 2-35.

TOOLSTEEL SALES: Major producer of toolsteels has immediate need for experienced toolsteel sales personnel in New Jersey and Metropolitan New York areas. Metallurgical or toolmaking background desirable. Product sales experience in area would be an advantage but not essential. Salary commensurate with experience and training. Box 2-40.

South

METALLURGIST: Exceptional opportunity available for graduate metallurgist with five years laboratory work. Position involves application of metallurgy in aluminum fabrication problems including extruding, forming and joining with some limited research and interpretation of test results. Affords excellent opportunity for man possessing leadership qualities. Excellent salary and top benefits. Contact: Reynolds Metals Co., 2000 South Ninth St., Louisville 1, Ky.

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ORDNANCE ENGINEER: Age 38, B.S. degree in metallurgical engineering, 14 years experience supervising and administrating tests, development and production of ordnance materials. Desires position in management. Box 2-45.

METALLURGICAL ENGINEER: B.S. degree, age 33, married, veteran. Seven years experience in high-temperature alloy development, including nuclear work, metallurgical analysis of material failures and manufacturing problems, laboratory supervision, metallurgical consultation on design. Seeks permanent technical position as metallurgist in progressive concern, preferably in Connecticut. Box 2-50.

METALLURGICAL CHEMIST: Ph.D. degree, over 40, married, two children, citizen. Considerable experience in nonferrous metals, notably cobalt, nickel and tungsten. Conversant with Caron process. Expert knowledge of cobalt, nickel separations. Prefers position in research and development. Resume upon request. Box 2-55.

METALLURGICAL ENGINEER: Graduate, age 32, with 11 years industrial experience, majority of which involved steel mill activity including development metallurgy, supervision and customer contact. Interested in physical metallurgy and engineering activity in medium-sized fabricating concern. West Coast or Midwest preferred. Minimum salary $10,000. Box 2-60.

PHYSICAL - MECHANICAL METALLURGIST: Age 30, M.S. degree, expects Ph.D. in summer. Background includes studies in mechanical engineering and metallurgy. Experience in basic research in ferrous and aluminum alloys, publications. Seeks position as metallurgist in research or development field, if possible in connection with teaching. Western states preferred. Box 2-65.

METALLURGICAL ENGINEER: Age 36, B.S. in general engineering, B.S. in metallurgical engineering. Married, one child. Seven and one-half years A.E.C. experience. Liquid metals, alloy development, high-temperature alloy fabrication, brazing alloy development, and applications. Fuel and control component development, production, irradiation testing. Reactor materials application, specification and quality control. Supervisory and fiscal experience. Box 2-70.

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PROJECT ENGINEER: With 15 years experience in general processing and production engineering with light industry. Desires challenging position in production engineering or sales engineering. B.S. degree, married, three children, age 38. Box 2-80.

METALLURGICAL ENGINEER: M.S. degree, age 30, married. Five years experience, two as engineering officer and past three years as research and development officer in Air Force doing high-temperature materials research. Desires basic research position in Northeast with opportunities for further education. Available September. Box 2-85.

METALLURGICAL ENGINEER: B.S. degree, age 24, family. Presently finishing service as Air Force officer, available July 15. Interested in quality control. Experience includes drafting, ultrasonic inspection and supervision. Prefers West Coast, also will consider overseas possibilities. Box 2-90.

MATERIALS AND PROCESS ENGINEER: Degree, age 35, family. Thirteen years of varied research, development and production experience at all levels of responsibility. Full knowledge of metalworking processes as applied to gas turbines, precision equipment, alloy manufacture. Proven administrator, technical writer. Desires responsible management position utilizing full background. Box 2-95.

METALLURGICAL ENGINEER: With 30 years experience in user's problems with steel, including application, properties, purchasing, processing, heat treating, hardening, casehardening, nitriding, stainless high-temperature alloys, etc. Will accept responsibility as materials engineer for reputable concern. Box 2-100.

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A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $100, will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters in Cleveland.

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